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Alternating Current Electrolysis

Results of Further Experiments on the Generation of Explosive Gases in Electrical Heating Equipment of the Water-Resistor Type

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Paper to be presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

It was observed, early in the history of electrochemistry, that an alternating current, when passed by means of electrodes through an electrolyte, would, under certain conditions, decompose the water and under other conditions cause no visible decomposition. The dangers of experimentation were complained of by De la Rive as early as 1837. In all cases the gases produced, (hydrogen and oxygen), were less than that required by Faraday's law. Attention was drawn to this by Maneuvrier and Chappuis[1], who give empirical laws drawn from their observations. These laws led to the theoretical considerations of Mengarini[2] and Malagoli[3], to whom further reference will be made. The work of Hopkinson, Wilson and Lydall[4] and of Marsh[5] on certain phases of the subject are also of importance.

The comparatively new application of electric power in which it is transformed into heat by passing, by means of iron electrodes, an alternating current directly through natural water, has brought up again the subject of electrolysis by alternating currents. The recent experimental work of Shipley and Blackie[6] has shown conclusively that the products of electrolysis are found in electric heaters of the water-resistor type. An extensive series of experiments was begun some time ago in the chemical laboratory of the University of Manitoba to determine the factors which affect the decomposition of water by alternating currents, with the object in view of discovering what conditions, if any, would reduce the production of explosive gases to a minimum or completely eliminate them.

Preliminary Experiments

In order to arrive at the underlying principles, experiments were first performed with platinum electrodes. The apparatus used was a miniature heating system, in which the electrodes were rectangular pieces of platinum foil of dimensions 1 by 2.5 by 0.0063 centimetre, and the electrolyte was tap water. At currents below 0.2 amperes no gas was evolved, but above this current evolution took place, at first on the sharp corners, and at higher currents along the edges of the electrodes. Only at currents of 3 or 4 amperes was gas evolved from the flat surfaces. The gases were found to contain two volumes of hydrogen to one volume of oxygen mixed with a little air.

Similarly, miniature heaters using carbon electrodes and circular rods of iron gave large quantities of gas from the exposed edges or ends. In the case of carbon, the gases produced contained a quantity of carbon dioxide as well as hydrogen.

The Importance of Current Density

If one draws or imagines the equipotential surfaces about electrodes immersed in a uniform conducting medium, it is readily seen that the current density will be greatest on any projecting points or edges. The sharper the projecting point or edge the greater will be the current density on this point or edge, and it may amount to many hundred times that on the flat surface. The exact value of this local current density may be obtained with difficulty by complicated integrations, but will undoubtedly be found to be related to the curvature. The greater the curvature the greater the current density, and the current density will be

1. MM. Maneuvrier and J. Chappuis. Elect. XXI, p. 237, 1888; (Comp. Rend. CVI, p. 1719); Elect. XXI, p. 403, 1888.
2. G. Mengarini. Elect. XXVII, p. 304 and p. 334, 1891.
3. R. Malagoli. Elect. XXXI, p. 259, 1893.
4. J. Hopkinson, E. Wilson and F. Lydall. Proc. Roy. Soc., Vol. 54, p. 407, 1893.
5. S. Marsh. Proc. Roy. Soc., Vol. 97, p. 124, 1920.
6. J. W. Shipley and A. Blackie. Engineering Journal, Vol. IX, No. 2, p. 55, 1926.

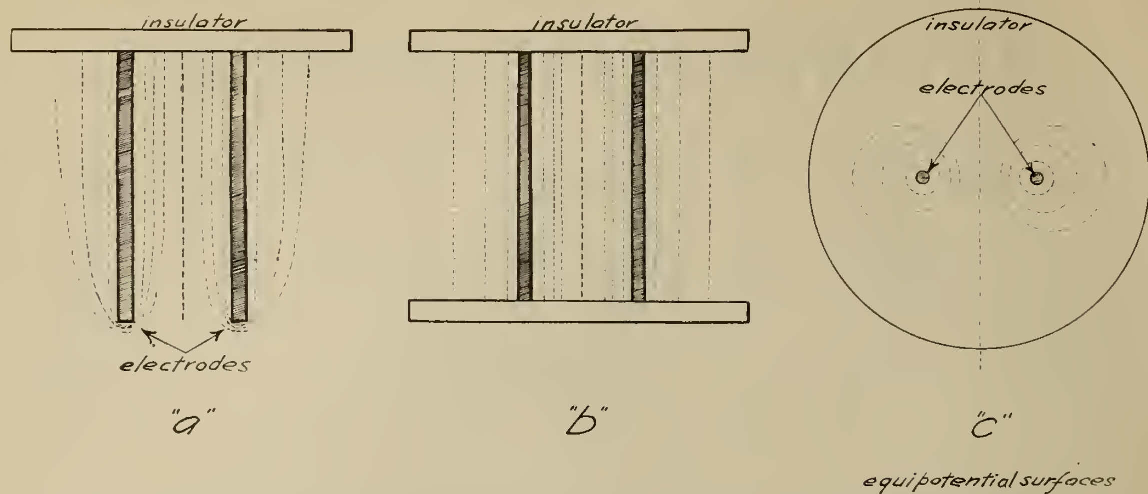

Figure No. 1.—Equipotential Surfaces about Unprotected and Protected Electrodes. (a) Unprotected Electrodes. (b) Protected Electrodes. (c) End View of Protected Electrodes showing Equipotential Surfaces as Approximate Concentric Cylinders.

a minimum when the curvature is zero, that is, on a flat surface.

This variation of current density has been totally neglected by early experimenters, and but briefly mentioned by Marsh (loc. cit.). The preliminary experiments of this research, having shown that gas is first produced at the places of high current density, showed also that no progress could be made without a design of electrode in which the current density is as nearly as possible uniform over the surface. Current density is the primary factor in the production of gas by alternating current electrolysis. In the remainder of this paper all references will be to current density in amperes per square centimetre.

Methods of Obtaining Uniform Current Density

The theoretical method of obtaining uniform current density would be to use two perfect spheres, separated by a distance, great as compared with their diameters, the boundary of the conducting liquid being also at a distance from the spheres, which is great as compared with their diameters. This, of course, is not practical.

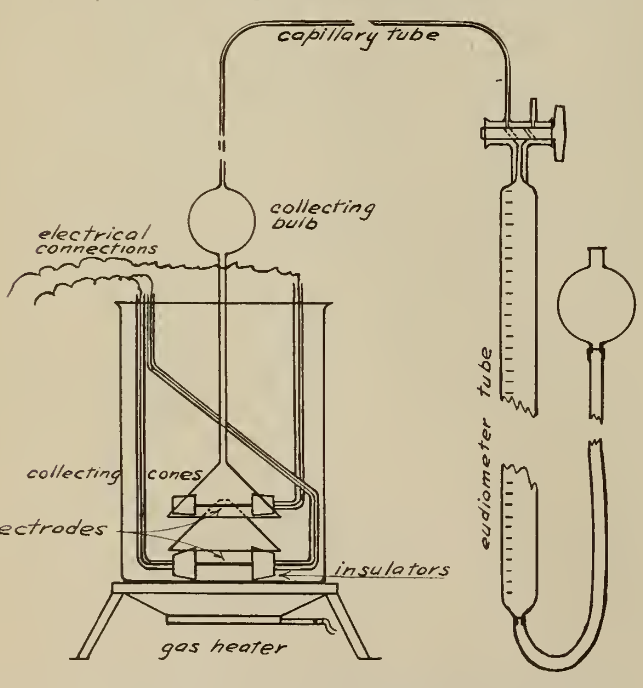

Figure No. 2.—Apparatus for Determining Rate of Electrolysis by Alternating Currents, showing Electrodes and Gas Collecting Apparatus. The Temperature Controlling Apparatus is not Included in the Diagram.

A second method which was tried with some success was to use two circular discs fitting tightly into the ends of a glass cylinder. The electrodes were parallel and the current density was shown to be fairly uniform by the uniform evolution of gas over the surface. The difficulty of taking care of the heat developed makes this arrangement generally impracticable and its experimental usefulness was limited.

The final method by which, as was shown later in the research, a current density of a high degree of uniformity was obtained, was as follows:—

Shielded Electrodes to Obtain Uniform Current Density

The cause of the high current density on projecting points is, that from such points the current may travel through a larger body of liquid, and therefore by this path the resistance will be less. It does not matter in which direction the point is, for the current will pass through all possible paths from one electrode to the other. Equipotential surfaces will be closer together, and closer to the point than they will be on the flat surface. It therefore occurred to the authors to shield the ends of the electrodes to make the resistance in all directions equal.

A combination of the two above theoretical methods was designed in which two identical cylindrical rods or tube electrodes were projected from one flat insulator to another, separated by a distance, great as compared with their diameter. The cylinders were of a convenient diameter, and were parallel to one another. The insulating plates were also parallel and their boundaries were at a great distance, as compared with the diameter of the electrodes. No part of the electrodes except that between the insulating plates was in contact with the liquid. This design is shown in figure No. 1-b.

Thus the equipotential surfaces were nearly concentric cylinders, as shown in the figure. A cross-section of these is shown in figure No. 1-c.

The position of the equipotential surfaces about the electrodes with one insulating plate removed is shown in figure No. 1-a. The current at any point varies inversely as the distance to the nearest equipotential surface.

Proof of the uniformity of current density, using this type of electrode, was obtained in later experiments. It was found that the rate of corrosion of the electrode was roughly proportional to the current density. When one part of the rod electrodes for some reason corroded away more than other parts, the current density was increased on this narrower part, causing greater corrosion and eventually cutting it in two. In the experiments, the results of which are given in this paper, the corrosion was uniform, and in one case the electrode, although 86 per cent corroded away, did not vary in diameter more than two-thousandths of a centimetre over its entire surface.

In the latter part of this research the above method of obtaining uniform current density was slightly varied by placing the electrodes between separate pairs of insulators, as shown in figure No. 2. The electrodes were placed further apart and observations were made on each separately.

Experiments at Low-Current Densities

The apparatus used was again in its essentials a miniature hot water heating system. The electrode chamber was a glass bulb and contained six electrodes of mild steel, (carbon content, 0.174 per cent), the exposed length of each was 9 centimetres, and the diameter was 0.68 centimetre. The ends of the electrodes were protected by a large rubber stopper at the top and bottom. A suitable inlet and outlet for the water were provided. The electrodes were connected to a distributing board, by which any combination could be connected through the ammeters and resistances to the switchboard.

Above the electrode chamber was placed a specially-designed gas trap by which the water was rotated, forcing

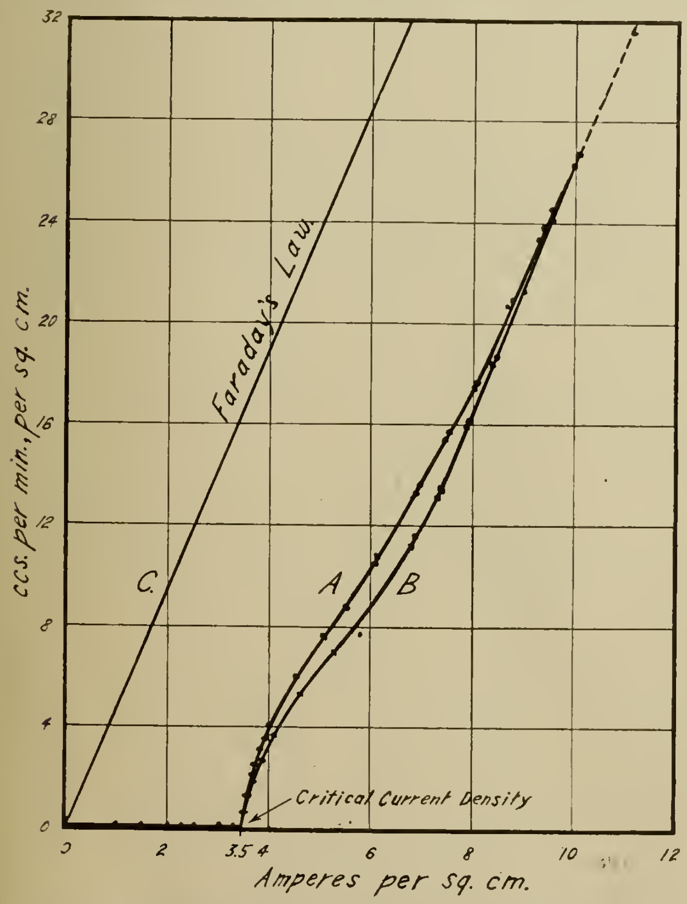

Figure No. 3.—Relation of Rate of Generation of Electrolytic Gases to Current Density. The Change in the Rate Agrees with Faraday's Law above the Critical Current Density.

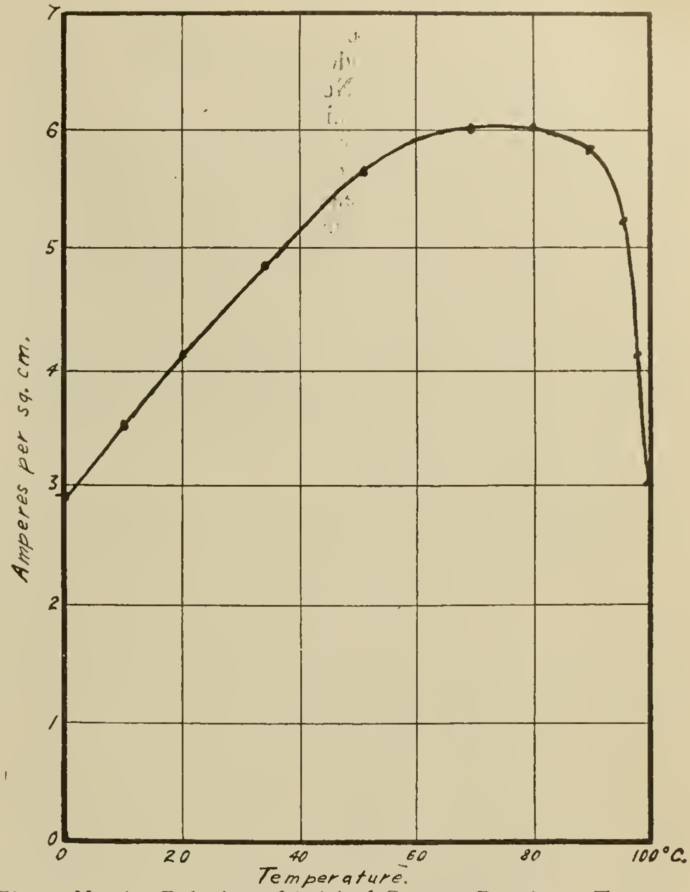

Figure No. 4.—Relation of Critical Current Density to Temperature at Atmospheric Pressure and with Iron Electrodes.

the gas away from the water outlet to the collecting apparatus. The remainder of the apparatus consisted of controlled cooling jackets, reservoir, thermometers, etc. To prevent accidents due to a possible explosion, a control was designed to cut off the circuit if the electrolyte did not completely fill the electrode chamber, or if the reservoir level varied to a dangerous extent. The gases that collected were analyzed for hydrogen by the copper oxide method to an accuracy of one-tenth of one per cent.

Using a dilute solution of sodium hydroxide, (approximately 0.005 normal), as electrolyte and operating at the boiling point, readings were taken at gradually-increasing current densities. The fresh electrodes with a polished surface produced traces of electrolytic gases for a few minutes, but the electrodes darkened and the evolution of gas ceased. Fifteen readings were taken, each being for an average period of twenty hours at current densities starting from 0.037 amperes per square centimetre and taken at intervals of approximately 0.01 amperes current density. The highest value was 0.2 amperes current density. The gases that collected were residues from the steam *and in no case was hydrogen detected.* The analyses averaged about 90 per cent nitrogen and 10 per cent oxygen. This is evidently due to air having been brought into the system and part of the oxygen having been combined with the iron.

These experiments indicate that an electric boiler can operate under the conditions given above at a current density of 0.2 amperes per square centimetre, (1.3 amperes per square inch), without producing explosive gases.

Experiments at Higher Current Densities

The above apparatus, although capable of high accuracy in collecting gases, had a limited range of current densities, and the temperature, an important factor in the production of gas, was difficult to control. An apparatus was developed in which the electrodes were on separate pairs of insulators, as shown in figure No. 2.

A four-litre beaker contained the electrolyte. The gases, when evolved, were collected by a pair of cones and a bulb, and were drawn off into a eudiometer tube situated at some distance from the heater. The temperature was controlled by a mercury thermostat control operating electric relays, which, in turn, controlled the water supply from a constant pressure reservoir to a copper cooling coil in the electrolyte. The reservoir was replaced by an ice-brine bath for low-temperature experiments. A motor stirrer kept the whole at a constant temperature. Auxiliary gas and electric heaters were fitted. Certain accessories, such as thermometers, ammeters, resistances, etc., were included. The design had the advantage of allowing ready removal of the electrodes for examination.

A series of experiments was again carried out, at the boiling point, in which the current density was raised in successive readings from 0.2 amperes per square centimetre to 2.0 amperes, (13.0 amperes per square inch). The same mild steel was used for the electrodes. In no case was hydrogen detected in the residual gas. The last experiment of this series operated for a period of twenty hours at a current density of 2.0, without the production of electrolytic gases. The electrodes became black.

On raising the current density to 2.5 the first traces of hydrogen were discovered. The rate of evolution, which was very low, increased slowly up to a current density of 3.5, above which it rose rapidly. The gases produced were violently explosive, and on analysis they were found to contain, by volume, two parts of hydrogen to one part of oxygen. At a current density of 5.0 and above, arcing took place and the current became irregular. The highest value was 7.0 amperes per square centimetre, at which the rate

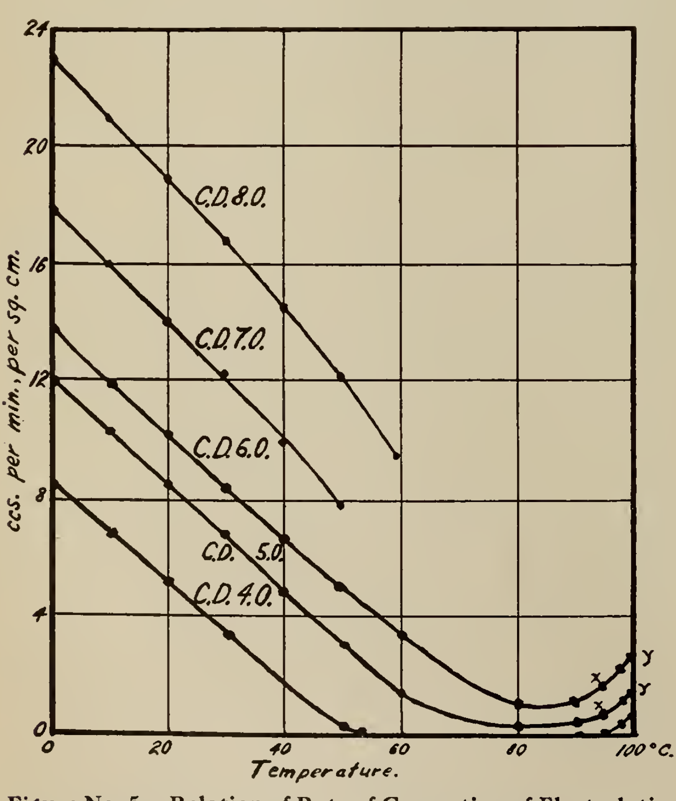

Figure No. 5.—Relation of Rate of Generation of Electrolytic Gases to Temperature, with Iron Electrodes.

was 6.8 cubic centimetres of electrolytic gas per minute per square centimetre of electrode surface. This measurement was made from one electrode only.

Critical Current Density

The existence of a "critical current density," below which no decomposition takes place and above which there is rapid decomposition, has been definitely established in the course of this research. Over thirty series of experiments of from ten to fifty observations in each, using steel electrodes under varying conditions, gave a value of current density above which electrolytic decomposition suddenly commences. In the preliminary experiments, in which the current density was not uniform, the critical point was gradual, while in later experiments its position could be found to one-tenth of an ampere. This position was found to vary as conditions were varied, such as corrosion, temperature, etc. These factors will be discussed presently.

Twelve series of experiments, similar to the above, indicated a very definite critical current density with platinum electrodes. The position of the critical current density for platinum was lower than iron and depended on such factors as temperature and coating of the electrodes.

Experiments at Lower Temperatures

Operating at a temperature of 30° Centigrade, the current density was successively increased from zero to 10.0 amperes per square centimetre. Piano wire steel was used for the electrodes and half-normal sodium hydroxide for the electrolyte. No decomposition took place until a current density of 3.5 was reached. The rate at which electrolytic gases were produced from one electrode in cubic centimetres per minute per square centimetre, corrected to standard conditions, is shown, plotted against the current density by the curves *A* and *B*, (taken under the same conditions but at different times), in figure No. 3. Readings were taken at half-ampere intervals above a current density of 4.0 and at one-tenth-ampere intervals near the critical point, and each reading was verified by three to four duplicates. These duplicates are not shown in the graph.

Similar curves were obtained at different temperatures and different states of corrosion. These were of the same slope as *A* and *B*, but were displaced to one side or the other.

Relation of A. C. Electrolysis to Faraday's Law

One ampere of direct current in one minute would produce, in accordance with Faraday's Law, 10.4 cubic centimetres of electrolytic gas at standard conditions. As the ammeter reading of an alternating current is 1.11 times the average current for each wave, and as the average current is the electrochemical current, one ampere of alternating current should theoretically produce 9.42 cubic centimetres per minute. One electrode should produce 4.71 cubic centimetres of electrolytic gas per minute. This is shown by curve *C* in figure No. 3.

It was found that above the critical point an increase of one ampere increased the rate of gas production by 4.71 cubic centimetres per minute, within the limits of experimental error. (There is a small discrepancy close to the critical point.) This is shown in the graph by the curves *A*, *B* and *C*, the upper part of A and B having the same slope as that of C. *Above the critical current density alternating current electrolysis follows the law of direct current electrolysis, provided that the critical current density is subtracted from the current density used.* When the critical current density is reached, all the current above that point generated electrolytic gases, which are freed from the electrode. This law for alternating current electrolysis was developed from over one thousand observations on the rate of gas production with iron and platinum electrodes.

Influence of Temperature on Critical Current Density

The initial point at which gas is evolved was determined over the range of temperature 0°C to 100°C. It was found that the critical point rose rapidly to a maximum at about 80°C and fell off to a value of 3.0 amperes at the boiling point. This is shown in figure No. 4.

The rise in the first part of this curve indicates that gas was first evolved at a continuously-increasing current density, as the temperature was raised. On the formation of steam on the electrodes the critical current density was lowered, the extent of the lowering increasing with the increase of steam formation. The rise is due, we believe, to an increase in the velocity of the secondary reactions with a rise in temperature. The catalytic activity of the surface, which, it seems probable, is largely responsible for the secondary reactions, evidently increases with the temperature. Further reference to these secondary reactions will be made later. The formation of steam on the electrodes probably has a washing effect whereby recombination is partly prevented by the removal of some of the products of electrolysis. The part played by temperature in this phenomenon is being further investigated.

All of the experiments of this research were carried out at atmospheric pressure. Increasing the pressure would increase the temperature at which boiling takes place, and the drop in the curve would take place near the new boiling point.

Other Factors Which Affect Critical Current Density

Fresh metallic electrodes produce gas at a lower current density than corroded electrodes. The extent of the corrosion is very important. At constant temperature moderately corroded electrodes gave a critical point at 3.5 amperes per square centimetre, whereas heavily corroded electrodes were found to produce no decomposition at a current density of as high as 9.5 amperes. It is to be remembered in this connection that the current densities given are the apparent current densities. No allowance can be made for pitting of the electrodes, which would thereby increase the actual surface. Apparent current density is all that is necessary for practical considerations.

No marked difference in the position of the critical current density was observed when the electrolyte was prepared from an acid or a salt. The corrosion of the iron in the normal salt solution and the acid solution was much greater than in the sodium hydroxide solution. Alkaline solutions have thus a practical advantage.

Mild steel was found to have normally a higher value for its critical current density than hard steel, such as piano wire. This will be investigated further. The critical current density using platinum electrodes was very sharp at 0.75 amperes per square centimetre at 30°C.

Effect of Temperature on the Rate of Electrolysis

Typical curves for steel electrodes, in which the rates of evolution of gas at constant current densities are plotted against the temperature, are shown in figure No. 5. Numerous curves representing different states of corrosion to that of those shown were obtained. They were all of the same form, but were above and below the position of those in the figure. The rate drops rapidly with rising temperature to a minimum at 80°C and rises again at the boiling point. These curves are related to the critical current density curves by the relation to Faraday's Law given above.

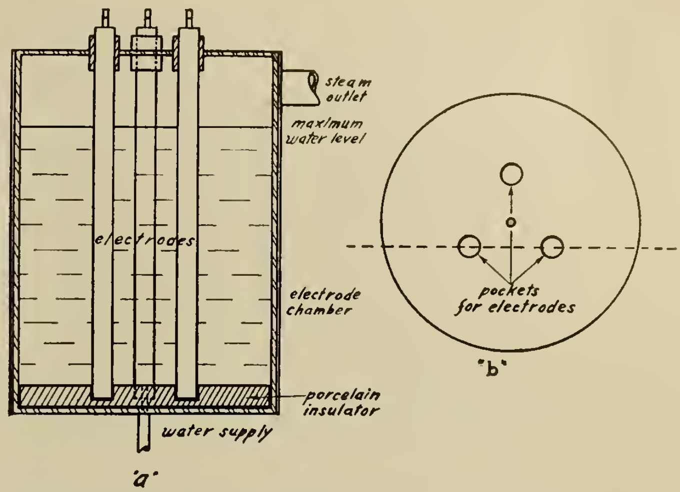

Figure No. 6.—Proposed Design (1) of Electrode Chamber in Electric Boilers for the Prevention of Generation of Explosive Gases. (a) Cross-Section of Insulator and Boiler. (b) Insulating Plate.

Effect of Arcing

Arcing took place to some considerable extent at high current densities and temperatures, and was associated with vigorous boiling. A slight increase in the rate occurred along with the arcing, but this increase was no greater than the normal increase at the boiling point without arcing. In figure No. 5 the parts of the curves for current densities 5.0 and 6.0 marked "*xy*" indicate where arcing took place. The rise in these parts is no greater than the rise in the curve below, in which there was no arcing.

A large number of experiments were performed in which arcing took place, and in no case was it found that arcing made any appreciable difference in the rate of electrolysis. Actual observations showed a decided drop in the rate with arcing, but when the rate was corrected for the change in area due to steam coating, (calculated from the change of resistance), the curve shows the normal rise.

These results are not in agreement with the statement made by Kaelin and Matheson[7], who assume that no decomposition takes place except thermal decomposition in arcs on the electrode surface.

Other Factors Affecting the Rate of Electrolysis

All of the above experiments were carried out using 60-cycle alternating current. The effect of changing the frequency has been experimented with by Maneuvrier and Chappuis, (loc. cit.), who found that increasing the frequency decreases the rate of gas formation. The relation is not simple.

Our experiments were carried out at voltages below 110. Electrostatic effects and an increase in arcing might be expected at high voltages. Whether these factors have any appreciable effect or not on the evolution of gas is being investigated.

Theoretical Considerations

Before proceeding with the theoretical considerations, it must be understood that the primary question is, "Why does an alternating current not bring about electrolysis according to Faraday's Law?" An alternating current is only a series of equal and opposite direct currents each of which must liberate its equivalent of electrolytic gases according to Faraday's Law. Why, then, does not the sum

7. F. T. Kaelin and H. W. Matheson, Eng. Jour. IX, No. 2, p. 198, 1926.

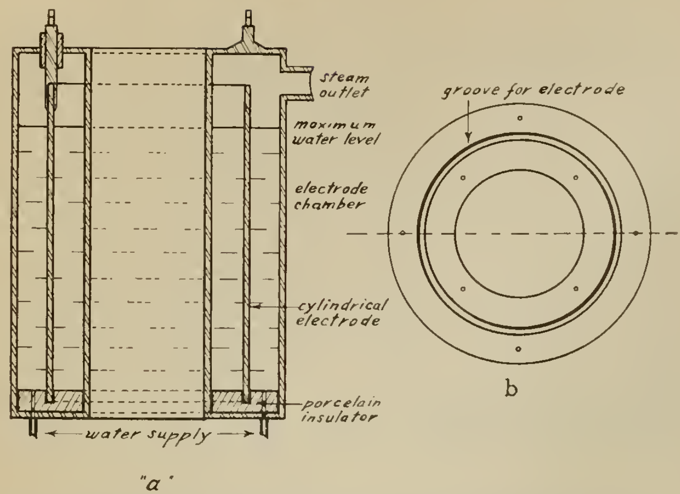

Figure No. 7.—Proposed Design (2) of Electrode Chamber in Electric Boilers for the Prevention of Generation of Explosive Gases. (a) Cross-section of Insulator and Boiler. (b) Insulating Ring.

total also obey the law? The answer probably lies in secondary reactions which remove all or part of the electrolytic products by recombining them to form water. The extent of these secondary reactions determines the critical current density. The surface of the electrode plays an important part in these secondary reactions by storing up part or all of the products from the second half of one half-wave to allow them to react with the products of the first half of the second half-wave. Catalytic action is undoubtedly involved. The capacity of the electrodes is limited, and if the current is such that the individual quarter-wave produces more gas than can be stored the excess will be liberated.

If other variables, such as frequency, temperature, etc., are constant this "electrolytic capacity,"[8] as it may be called, is constant over the range of current densities used in the experiments of this research. This accounts for the constant difference between the rate of alternating current electrolysis and direct current electrolysis, as shown in figure No. 3.

Malagoli, (loc. cit.), made an important contribution to the theory of alternating current electrolysis, in which he treated the subject with mathematical precision, but gave no experimental evidence in support of his equations.

Practical Considerations

The first principle to be observed in preventing alternating current electrolysis is the obtaining of uniform current densities. Pipe or rod electrodes with exposed, rounded ends, as at present used, will produce high current densities on these ends. The current density used commercially in steam-producing electric boilers is about 0.75 amperes per square inch, as calculated on the assumption of uniform current density. Above this density, decomposition of the electrolyte becomes serious. From the above experimental work, it is seen that electrodes producing steam can be operated at a current density of 13 amperes per square inch without decomposition of the electrolyte, which density is some distance from the critical point of 19 amperes per square inch. Such a high current density as 13 is impracticable due to difficulties in handling the steam, but the present-day boiler can be made safe and its heating capacity increased to a considerable extent if the electrode chamber is designed to obtain as far as practicable the conditions of uniform current density.

Two suggested designs of such electrode chambers are shown in figures Nos. 6 and 7. In one the three electrodes are placed symmetrically and vertically in a metallic cylindrical tank, as shown in figure No. 6. No special arrangement at the top is necessary as long as the water level remains below the steam outlet. The essential feature is the large porcelain insulator at the bottom. This is a circular plate which fits the bottom of the chamber with three shallow pockets for the ends of the electrodes, (figure No. 6-b). No great thickness of the porcelain is necessary, as there is no strain upon it. A hole is provided through the centre of the porcelain and the electrode chamber for the water supply. The above arrangement with electrodes of two inches diameter, separated from one another and the walls of the chamber by ten inches, gives a high uniformity of current density.

Concentric cylinders might also be employed, as shown by figure No. 7. In this design the electrode chamber is built from two cylindrical walls and acts as one electrode. The other cylindrical electrode is inside. The porcelain insulator is a flat ring with a circular groove, as shown in figure No. 7-b. Numerous small holes give access to the water supply. This design is advantageous because of its compactness, but is limited in this form to single-phase current. A shamrock group of three such chambers, or an arrangement of three cylindrical and concentric cylinders in the same way as above is adaptable to three-phase current. In the second case the diameters of the cylinders would be such as to equalize the load. The limitation of the compactness of such a design would not be in the current density but in the handling of the steam. This is a problem for the electrical heating engineer.

Summary

(*1.*) The primary factor in alternating current electrolysis is current density.

(*2.*) For a given set of conditions, i.e., frequency, temperature, pressure, voltage and electrolyte, there is a critical current density for the electrode, below which no gas is evolved.

(*3.*) Above the critical current density gas is evolved per square centimetre according to Faraday's Law, provided that the critical current density is subtracted from the current density used. In other words, when the critical current density is reached, all the current above that point generates electrolytic gases, which are given off from the electrode.

(*4.*) The critical current density with iron electrodes varies with temperature, rising from 0°C to about 80°C and falling to the boiling point.

(*5.*) The rate of gas evolution with iron electrodes likewise varies with temperature, falling from 0°C to about 80°C and rising to the boiling point.

(*6.*) Arcing in itself makes no appreciable difference in voltages below 110.

(*7.*) The generation of explosive gases in the water-resistor type of electric heater can be prevented by a design of electrode chamber that would secure and retain under operating conditions uniform current density.

(*8.*) The current density in such a heater can be considerably increased over present usage without danger of the generation of explosive gases.

The research is being continued under a financial grant from the National Research Council of Canada.

8. "Electrolytic capacity," as used here, is measured, as distinct from electrostatic capacity or polarization capacity, in coulombs.

Rack Structure and Penstock Intake of the Isle Maligne Hydro-Electric Power Station

Features of Design and Construction of the Rack Structure and Penstock Intake of the Plant of the Duke-Price Power Company, Ltd., at Isle Maligne, on the Saguenay River

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Paper to be presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

The Isle Maligne station is a typical design in which the power house and water intakes are made part of the dam or impounding structure located as far downstream as possible so as to obtain the maximum possible head for the development.

This type of design is economical for heads between 60 and 120 feet, since it enables the designer to lay out short waterways, thereby reducing the friction losses and obtaining better regulating conditions for the turbines. In addition, it permits a downward sloping of the top of the water-

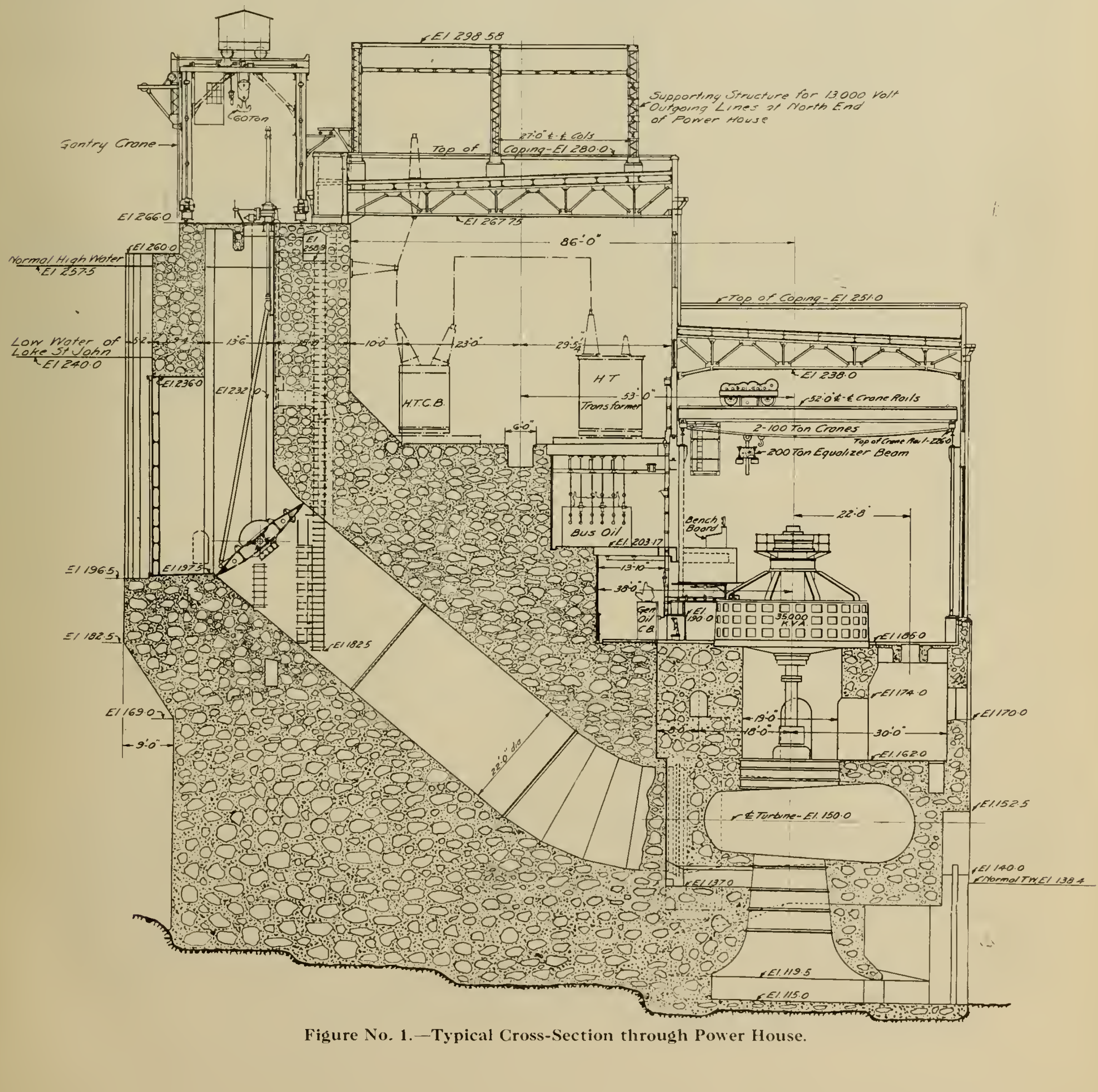

Figure No. 1.—Typical Cross-Section through Power House.

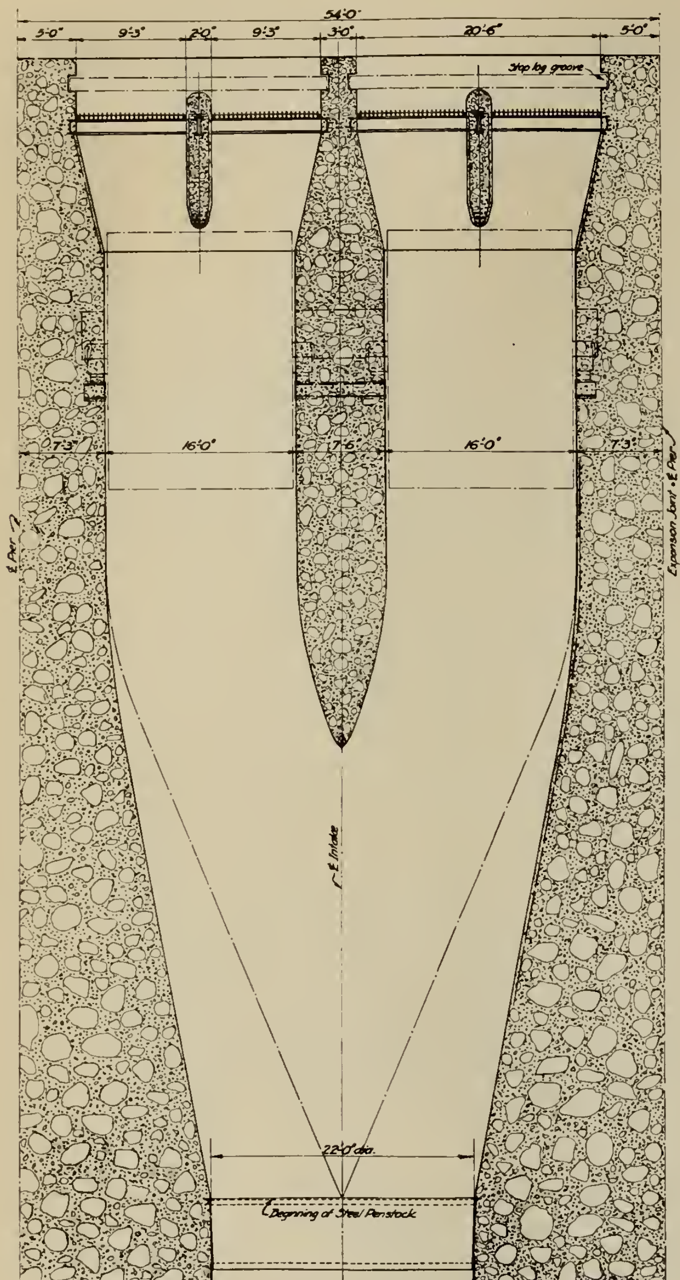

Figure No. 2.—Sectional Plan of Intake.

ways toward the turbine wheel case, so that no pockets of air can be formed.

By use of the modern single-runner vertical turbine, waterways of ample size may be formed in the impounding structure, leaving enough space for division walls to keep the stresses in the bulkhead and power house substructure within safe limits.

The 722 feet long power station at the foot of Isle Maligne, the last of the many islands in the Grand Discharge of the Saguenay river, is designed for twelve 45,000-horse power hydro-electric units, the operating head ranging between 100 and 117.5 feet, depending on the stage of lake St. John.

Power House Forebay

The power house forebay is an extension of lake St. John. At low water stage the depth of water in the forebay is more than 75 feet, and the velocity of approach of the water to the rack structure is negligible, even if all twelve turbines are operated.

The water is drawn into the intakes at an average depth of 30 feet below its surface, the top of the intake being always submerged, as shown in figure No. 1. It is not expected that anchor or frazil ice will be formed in winter time tending to clog up the racks. In general, the ice cover on lake St. John is from two to three feet thick.

Rack Structure

The rack structure forming the upstream portion of the power house bulkhead is built of reinforced concrete and structural steel with the top of the rack bars at elevation 236.0, leaving a margin of 4 feet below the ordinary low water level of lake St. John. Referring to the sectional plan and elevation of the rack structure and penstock intake, figure No. 2, there are four steel rack sections of 39 feet height and 9 feet 3 inches width each per unit. This subdivision of the rack structure permits, first, the placing of reinforced concrete baffle piers anchored to the masonry base at the bottom and to the 24 feet high masonry block on top, thus cutting in half the unsupported length of the horizontal steel beams to which the rack bars are attached, and, second, the fabrication of rack frames which can be shipped assembled to the power house site and quickly set in place.

The 6 inches by ⅜-inch thick steel rack bars of 39 feet 6 inches length each are spaced 4½ inches on centres, and the method of connecting same to the slotted angle irons and plates, which are riveted to the horizontal beams of the frames, is shown in detail in figure No. 3. It will be noticed that, with the exception of the cutting to the required length, the rack bars do not require any shop work. There are 24 rack bars per frame, and each set of bars was shipped in a bundle weighing 7,250 pounds. An upstream view of the rack structure nearing completion is shown in figure No. 4.

The rack structure is designed to withstand hydrostatic pressure against its covered upstream face due to ordinary high water of lake St. John and considering the penstock

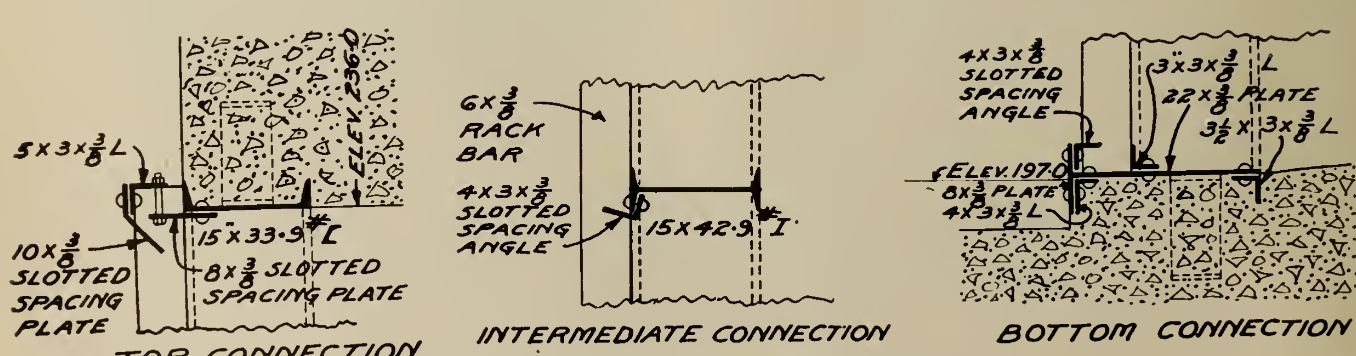

Figure No. 3.—Details of Racks and Frame Connections.

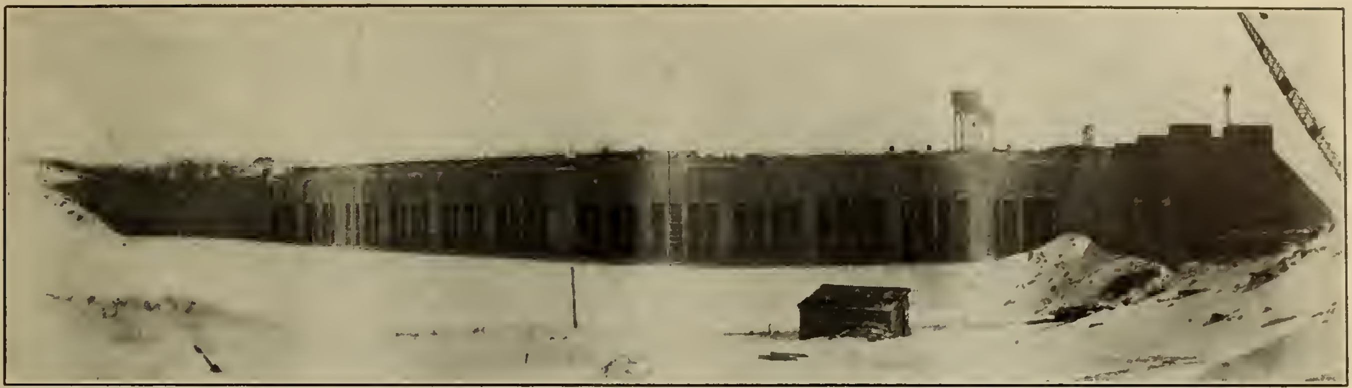

Figure No. 4.—Upstream View of Rack Structure During Construction.

intake unwatered. In this case the steel work will be stressed to its elastic limit. The grooves provided in the main piers extending further upstream from the face of the rack sections are for the insertion of stop logs, allowing an inspection of the racks. Under normal operating conditions there is no steel exposed to the action of the air, even if the lake is at its low water stage.

Penstock Intake

The waterway formed in the rack structure converges into the twelve bell-shaped penstock intakes, each of which is divided into two openings by a 7 feet 6 inches thick partition of concrete masonry. Each opening is controlled by a 16 feet wide by 22 feet high rectangular gate of the butterfly type, having in the centre a cast steel girder of 2 feet 8 inches depth and of 2 feet 6 inches width, with bronze bushed trunnions of 18 inches outside diameter and 24 inches length at each end. The wings of the gate are of cast iron, and are firmly attached to the girder by machine bolts and shrink links. The general design of the gate and frame, including its sealing devices, is shown on figures Nos. 5 and 6.

Each gate is operated by an individual, completely enclosed hoist located on top of the power house bulkhead, as outlined in figure No. 1.

Direct-current, 230-volt electric power is supplied for the operation of the hoists. Each headgate motor is completely enclosed, and has a starting torque of 275 foot-pounds and a running torque of 140 foot-pounds, based on six minutes service, with a temperature rise not exceeding 55 degrees centigrade. Under the most severe operating

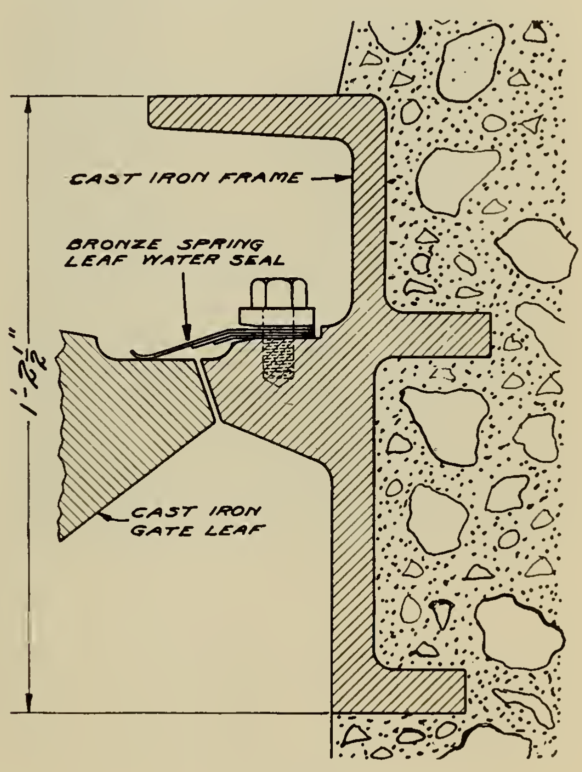

Figure No. 5.—Detail of Water Seal.

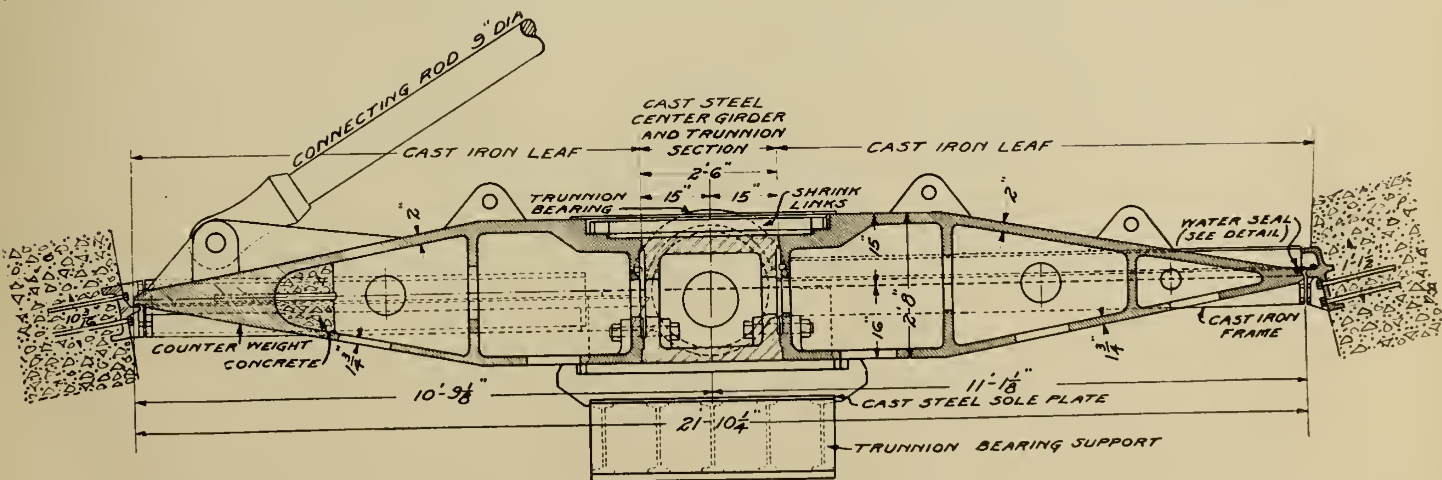

Figure No. 6.—Section Through Headgate.

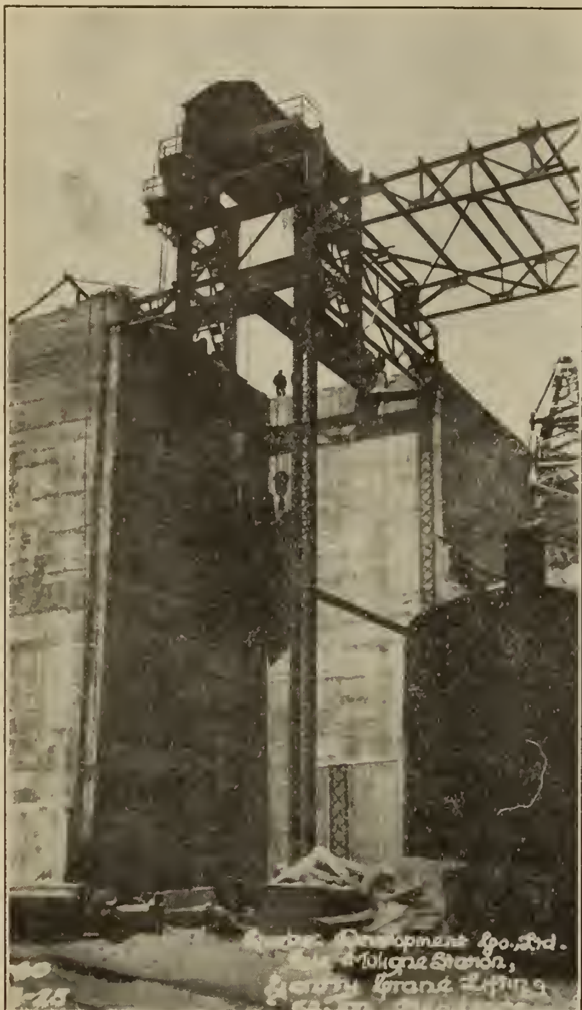

Figure No. 7.—Gantry Crane, Lifting 54-ton Headgate.

conditions the gate may be completely closed or opened in five minutes. A weather-proof push-button control station is provided for each hoisting mechanism on top of the bulkhead and a non-weather-proof control station on the power house benchboard for distant closing of each gate. The emergency push-button control on the benchboard is for use in case of accidents only, as the intake gates can be readily closed when the generator is operating under full load.

A 36-inch diameter by-pass is provided in each intake for filling the penstocks before the headgates are opened and the turbines started. By means of vents leading to a passageway near the top of the bulkhead the air will escape from or be admitted to the turbine flumes. This passageway has a number of side openings to both the space between the rack structure and the intake and to the transformer and circuit breaker room of the power house. In cold weather the warm air from the generators is passed through these side openings into the space below the headgate hoists, the object being to prevent freezing of the water surface above the headgates.

Each headgate weighs 108,000 pounds, excluding the weight of the frame, and railroad clearances permitted the gates to be shipped assembled in special cars. The travelling gantry crane on top of the bulkhead is provided with two hoists, the main hoist having a capacity of 60 tons and the auxiliary hoist of 5 tons, and it was used for unloading and lifting each headgate on top of the bulkhead and for transferring and lowering same to its respective position. In addition, the gantry crane has two bracket hoists of five tons capacity each, for lowering and raising stoplogs in front of the rack structure.

A view of the gantry crane lifting a headgate is shown in figure No. 7.

Logways

At each end of the intake structure provision is made for the removal of logs or floating matter from the forebay by means of a logway. Each logway opening is 5 feet wide by 12 feet high; it is controlled by a concrete-filled steel sliding gate which is in its raised position when closed. When it is desired to remove logs or debris, the gate is lowered a sufficient distance below the existing water level to allow the logs or debris to pass over the top of the gate.

The logs and debris taken through the opening at the north end of the intake pass through a tunnel formed in the power house bulkhead and substructure and finally discharge into the tailrace. The logway at the south end of the intake is formed in a section of the spillway adjoining the power house bulkhead.

Electrical Characteristics of the Quebec-Isle Maligne Transmission Line

Location, Construction and Electrical Features of the Transmission Line at Present under Construction between Isle Maligne and Quebec City

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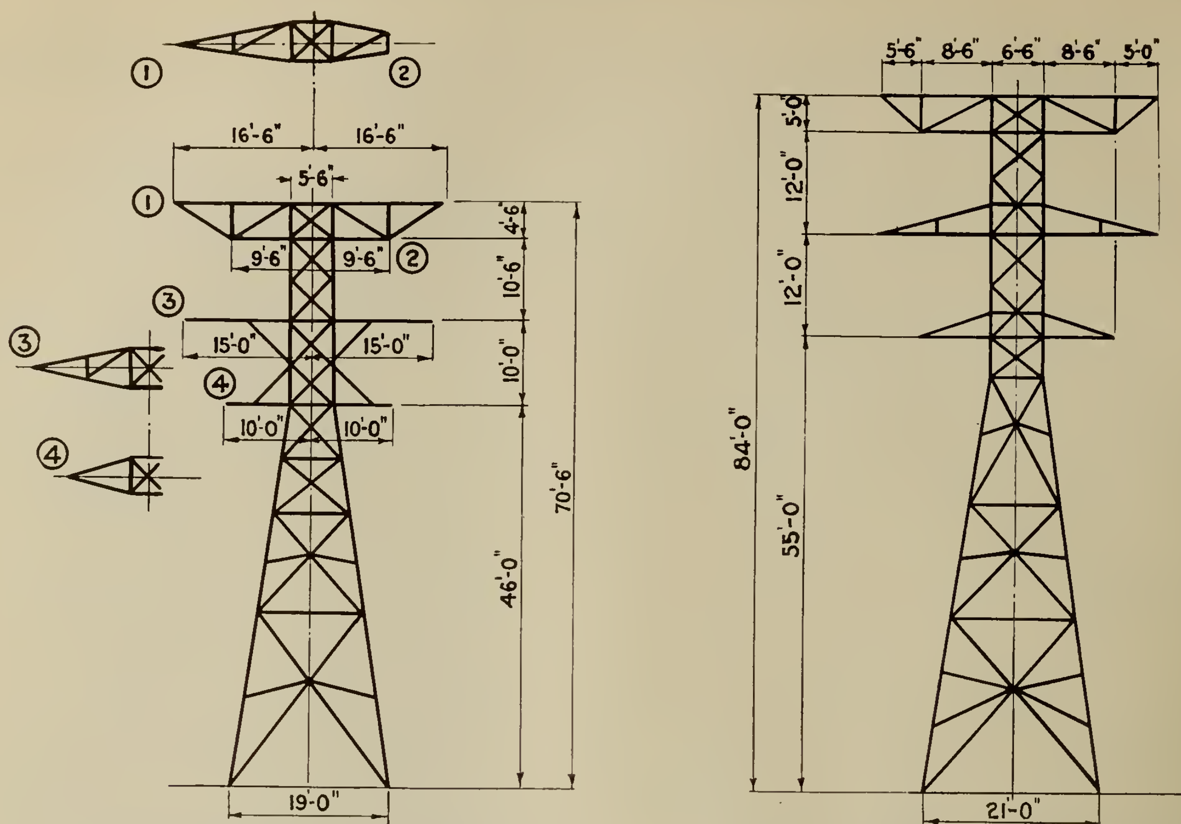
Paper to be represented at the Annual General Professional Meeting of The Engineering Institute of Canada. at Quebec, Que., February 15th to 17th, 1927

The harnessing of the great water powers of the Saguenay river in Quebec has been delayed for many years waiting for men who could combine the visions to see sufficient industrial development to utilize at least the main part of the power and who had the initiative and influence to carry out the project. The late J. B. Duke and the late Sir William Price saw the vision, and during 1925 and 1926, through the construction of the plant of the Quebec Devel-

Figure No. 1.—Transmission System of the Shawinigan Water and Power Company.



Transmission Lines Nos. 7 and 8, Shawinigan Falls to Montreal Standard Light Section Tower.

Transmission Line Quebec to Isle Maligne Standard Light Tower.

Figure No. 2.—Standard Transmission Towers.

opment Company at Isle Maligne, 350,000 horse power of electrical power has been made available; of this, about 150,000 horse power is used in the paper mills at Port Alfred, Kenogami and River Bend; 100,000 horse power in the new plant of the Aluminum Company of Canada at Arvida, leaving about 100,000 horse power which has been purchased by The Shawinigan Water and Power Company to supply the future demand for power in the Quebec district.

Choice of Location

To transmit this 100,000 horse power to Quebec, two routes were available; the direct route running straight across the Laurentide National Park, which surveys have shown to be 135 miles in length, and a second route extending down the Saguenay river to Ha Ha Bay, then across country to Baie St. Paul, and from thence direct to Quebec, a total distance of about 170 miles. The cost of high voltage lines is too great to unnecessarily increase their lengths, and the decision was made to follow the shorter route.

Surveys were completed in September 1926. Through the greater part of its length the line crosses virgin country, and it was necessary to build roads both for construction purposes and for patrolling. Shortly after leaving Isle Maligne the country rises to an elevation of about 2,000 feet above sea level and it returns to the lower level about 25 miles from Quebec. The maximum elevation reached by the lines is about 2,900 feet, near its centre.

Voltage and Number of Circuits

After extensive studies of the relative cost of transmission at 200,000 volts and 150,000 volts, a delivery voltage of 150,000 volts was adopted for Quebec, requiring approximately 165,000 volts at Isle Maligne on the line side of the step-up transformers. Provision has, however, been made for an increase of the delivery voltage to 160,000 volts if future load conditions warrant it.

Although, from the point of view of continuity of service and freedom from interruptions, it was desirable to use two single circuit lines on separate rights-of-way, the necessity of keeping down the capital cost of the line forced the decision to use a double circuit steel tower line. When the load to be transmitted to Quebec increases beyond 150,000 horse power, a second double circuit line will be constructed.

It is the purpose of this paper to discuss the electrical features entering into the design of this line and to make a comparison with the present 100,000-volt line of The Shawinigan Water and Power Company from Shawinigan Falls to Montreal.

The map (figure No. 1) shows the main transmission lines of The Shawinigan Water and Power Company, and shows the relation of the new line to that system.

The Quebec-Isle Maligne line is now in process of construction and will be ready for service in July 1927. It is a double circuit line with conductors of 397,500 circular mils aluminum cable, steel reinforced, is carried on steel towers with concrete foundations, and the normal span is about 900 feet.

Towers

The standard light tower is shown in figure No. 2, and beside it for comparison is the standard light tower used on the Montreal line. The light tower is designed to take angles up to 4°. Its weight is 10,400 pounds and the weight of the footing for each leg is 8,100 pounds, consisting of 2 cubic yards of concrete with reinforcing bars. The over-all height of the tower is 84 feet, and the cross-arms are spaced 12 feet vertically with an extension of 5 feet on the centre arm.

Conductors

The conductor used is 397,500 circular mils A.C.S.R. with an outside diameter of 0.806 inch. It is made up of 30 strands of aluminum of 0.1151 inch diameter over 7 strands of steel of the same diameter. The elastic limit of the cable is 13,800 pounds and its ultimate strength is 19,170 pounds. The calculated maximum operating stress is 10,000 pounds per conductor when operating with ¾-inch of ice and a 10-pound wind.

The conductors are spaced 12 feet apart vertically and the centre conductor has an off-set of 5 feet, giving actual conductor spacings of 13 feet, 13 feet and 24 feet, and the equivalent spacing used in the calculation of inductance and capacity is $\sqrt[3]{13 \times 13 \times 24} = 16$ feet.

Insulator Strings

Ten 10-inch discs are used for suspension and twelve for strain. The latter are high-strength units.

The complete string of insulators is shown in figure No. 3, with an arcing horn at the lower end. The over-all length of the string is 56⅜ inches. This compares with seven units and an over-all length of 42 inches for the 100,000-volt line.

Clearances to Steel

The towers are designed for the following clearances to steel:—

(1) 1/3 inch for each kilovolt in excess of 22 plus 12 inches for normal conditions. (Minimum for 154,000 volts = 56 inches.)

(2) ¼ inch for each kilovolt in excess of 7 plus 6 inches for intermittent condition. (Minimum for 154,000 volts = 43 inches.)

Hangers are designed for angles so that the minimum clearance to steel is 44 inches.

Tests have shown that at 60 cycles the flashover voltage from conductor to steel is about 9,000 volts per inch and to jump across the minimum clearance of 44 inches would require 400,000 volts.

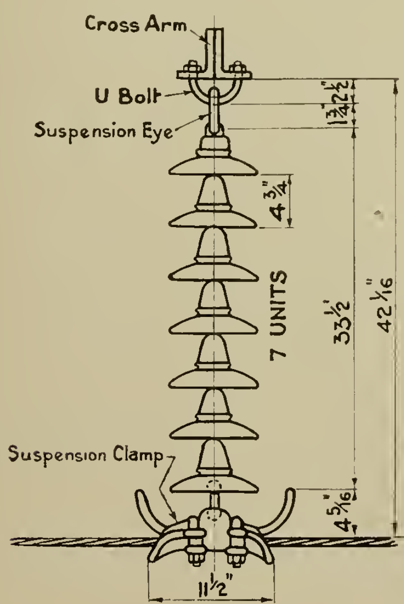
Two ground wires will be installed, 7/16-inch seven-strand steel.

Table No. 1 gives comparative characteristics for the 150,000-volt and 100,000-volt lines.

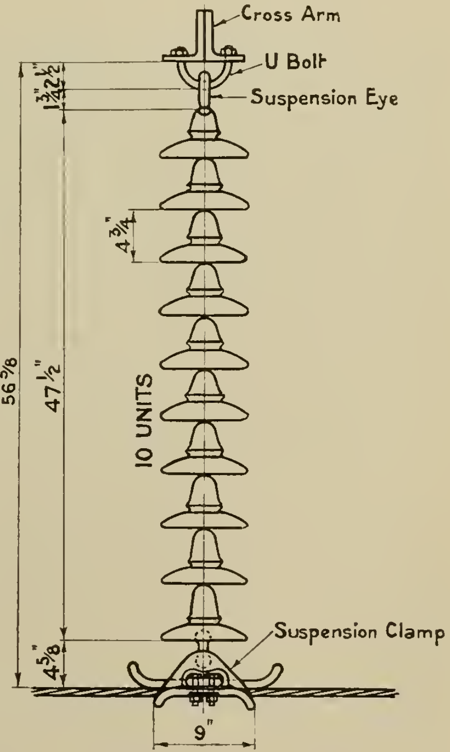
Table No. 1:—Comparative Characteristics for the 150,000-Volt and 100,000-Volt Lines.

(All figures refer to light towers)

Item	Isle Maligne Line	Montreal Line
Conductor	397,500 CM. A.C.S.R. { 30 alum. 7 steel	266,800 CM. A.C.S.R. } 6 alum. 7 steel
Spacing	13 ft. 13 ft. 24 ft.	11.2 ft. 11.2 ft. 20 ft.
Span	900 ft.	550 ft.
Weight of light tower	10,400 lbs.	5,300 lbs.
Weight of foundation per leg	2 cu. yds. = 8,100 lbs. per leg; 8 reinforcing bars, ½ in. x 5 ft. 0 in.	1.5 cu. yds. = 6,065 lbs. per leg.
Insulators	10 units suspension.	7 units suspension.
Light tower	Angles up to and including 4° 00′ are taken care of on light towers.	Angles up to and including 2° 00′ are taken care of on light towers.
Ground wire	2 7/16 inches—7 strand steel.	None installed.
Types of towers	Light, semi-anchor, anchor, transposition.	Light, heavy, river crossing right angle and transposition.



Suspension Insulators Lines Nos. 7 and 8, Shawinigan Falls to Montreal, Seven Units Suspension, Eight High-Strength Units Strain.

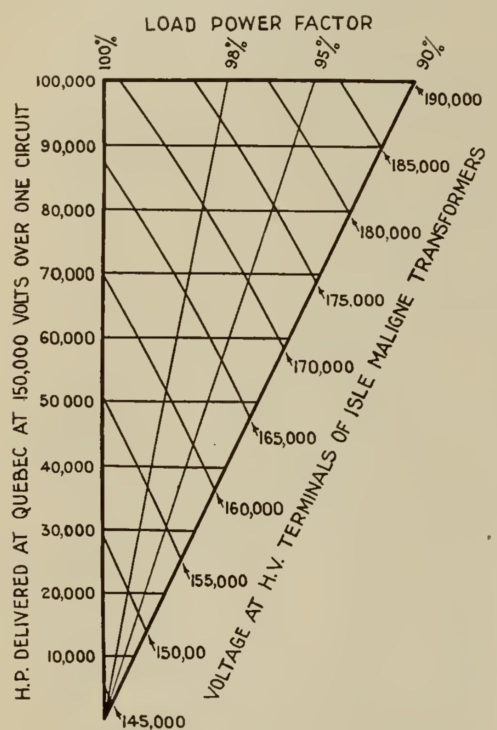


Suspension Insulators, Quebec to Isle Maligne, Ten Units Suspension, Twelve Units Strain.

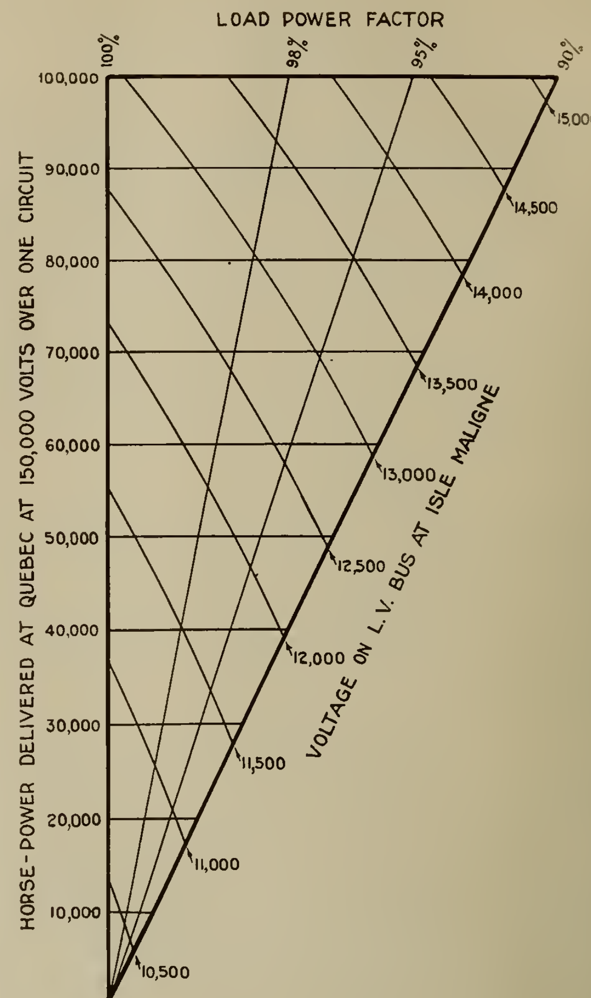
Figure No. 3.—Standard Suspension Insulator Strings.

Electrical Constants of the Line

The electrical constants of the line are as follows:—
Resistance per circuit at 40° C. = 34 ohms.
Reactance per circuit at 60 cycles = 102 ohms.
Capacity susceptance per circuit = 7.35 × 10^{-4} mhos.
Charging current per line at 150,000 volts = 63.5 amp.
Charging kv.a. per line at 150,000 volts = 16,400.
Charging kv.a. per line at 165,000 volts = 20,000.
The resistance of one bank of step-up transformers referred to the high-voltage side = 2.9 ohms.
Reactance of one bank of transformers = 51.25 ohms.



4a—Regulation Chart for Line Only—One Circuit.



4b—Regulation Chart, Line and Step-up Transformers—One Circuit.

Figures Nos. 4a and 4b.—Regulation Charts for the Isle Maligne Line.

Thus the reactance of the step-up transformers is half as much as the line reactance.

There will not be any corona loss on this line below 180,000 volts in fine weather. In stormy weather, corona loss will begin about 155,000 volts but will not be excessive.

Step-Up Transformers at Isle Maligne

The transformers at Isle Maligne are rated, single-phase, sixty-cycle, 25,000-kv.a., to be connected delta on the low-voltage side and star on the high-voltage side with permanently grounded neutral.

The ratio of voltages is 13,200 volts delta to 187,000 volts star with taps on the high-voltage side to give voltages 178,750, 170,500, 162,250 and 154,000 volts and the normal operating ratio will be 13,200 to 178,750 volts, and this is the ratio on which the regulation chart in figure No. 4-b has been constructed.

The efficiency at full load is 99.0 per cent; ¾-load, 99.1 per cent; ½-load, 99.0 per cent, and ¼-load, 98.6 per cent. The iron loss is 0.31 per cent at normal voltage, and 0.40 per cent at 110 per cent voltage; the copper loss, 0.64 per cent at full load; and the approximate reactance is 12 per cent.

The equivalent impedance of the transformer bank referred to the high-voltage side at the operating voltage ratio is $Z_{tr} = 2.9 + 51.3j$ ohms.

Regulation Charts

Regulation charts giving the operating characteristics of the line alone and of the line with step-up transformers are shown in figures Nos. 4a and 4b.

These diagrams were constructed using the most exact methods of calculation, but only the essential parts of the diagram have been retained in order to make them as convenient for use as possible.

When delivering 50,000 horse power per circuit to Quebec at 150,000 volts, 95 per cent power factor, the voltage required at the high-voltage side of the step-up transformers at Isle Maligne is 162,500 volts, figure No. 4-a, while the voltage on the generator bus is 12,200 volts, figure No. 4-b.

When delivering 100,000 horse power at 150,000 volts, 98 per cent power factor over one circuit, the voltage on the line at Isle Maligne is 177,500 volts and on the generator bus is 13,800 volts.

The capacity of this system of two lines will be about 150,000 horse power at 95 to 98 per cent power factor. When the demand at Quebec has increased beyond 150,000 horse power, further lines will be required.

The Water Power Developments of The Alouette-Stave-Ruskin Group of the British Columbia Electric Railway Company, Limited

E. E. Carpenter, M.E.I.C.
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Paper to be presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

The southwest coast of British Columbia is especially favoured by nature in the matter of water power resources. The heavy precipitation, varying from 100 to 200 inches at watershed elevations, falls largely in the form of snow upon the lofty peaks and rugged flanks of the Coast Range mountains, at altitudes that retain it in this form or in the form of glacial ice for a large part of the year. The lower watersheds are clothed with a dense forest cover that effectively retards the run-off. These conditions, coupled with the close proximity of the elevated Coast Range to the populous coastal districts, where the agricultural, commercial and industrial needs for electric energy are centred, tend to simplify water power problems in many ways.

The Company

The British Columbia Electric Railway Company, Ltd., owns and operates all power, light, gas and traction utilities serving the Pacific coast districts of British Columbia and the southerly districts of Vancouver Island.

The populous centres are the city of Vancouver on the mainland and the city of Victoria on the island. The former, with its suburban municipalities of Point Grey, South Vancouver, Burnaby, North Vancouver and West Vancouver, has a population of approximately 225,000; the adjacent communities, of which New Westminster is the principal one, raise this figure to 275,000. Victoria has a population of 60,000, to which its suburban districts add about 25,000.

There is no interconnection between the mainland and the island systems, nor is any practicable on account of the intervening water distance.

The records of power usage on the mainland point unmistakably to vigorous and sound future growth. Close study of the situation warrants the prediction of an annual incremental increase in total load approximating 10 per cent; a doubling of energy output for each period of 7 to 8 years in the future.

A glance at the past record shows that this rate of load growth has persisted in spite of the vicissitudes of the abnormally rapid expansions from 1910 to 1913, the recession period immediately following from 1913 to 1915, and

Figure No. 1.—Topographic Panoramic View of Alouette- Stave-Ruskin Power Developments.

the war period immediately following that. The mainland substation outputs for the year 1925 exceeded that of 1924 by 11 per cent. The power generated in 1925 amounted to 332,000,000 kw. hrs.

The doubling of the load during each 7 to 8 years means the doubling of the facilities for producing power in each similar period. The present hydro-electric generating capacity of all the plants of the mainland system,—including plants under construction,—is 123,325 kv.a. The doubling of this capacity by 1934 will mean an expenditure of some $25,000,000 in new plants, transmission lines, substations, etc., an annual expenditure in increasing power facilities of some $3,000,000 per year.

A summary of the company's plants and their respective capacities follows:—

Mainland Plants		*Capacity kv.a.*	
Buntzen No. 1	hydro	21,000	
Buntzen No. 2	"	26,700	
Stave Falls	"	65,625	
Alouette	"	10,000	
Vancouver	steam	12,500	
Total			135,825
Vancouver Island Plants			
Jordan River	hydro	16,000	
Goldstream	"	2,700	
Brentwood Bay	steam	4,000	
Total			22,700
Grand total			158,525

With the above outline of the company and the scope of its system as a basis of general acquaintance, the real subject of the discussion, the developments of the Alouette-Stave-Ruskin group, will be proceeded with. A glance at the topographic panorama, in figure No. 1, will disclose the relation of the three projects in a better way than descriptive text. The three plants utilize progressively the head available from the watersheds feeding the Alouette lakes and Stave lake. The developments existing and proposed will be discussed in the order of their place in the chain or series, beginning with the Alouette project, which lies at the highest elevation.

Alouette Development

The Alouette lakes lie in a narrow valley about eight miles north of the Fraser river and about twenty-five miles due east from Vancouver. They are drained by the Alouette river, which, after flowing southwesterly about fifteen miles, discharges into the Pitt river at tidal elevation.

At low water there are really two lakes separated by a short stretch of running stream, but, with the water level raised, the two merge into one. The lakes lie at an elevation about 140 feet above Stave lake and about 370 feet above mean sea level.

The raising of the level of the Alouette lakes by building a dam at their outlet, thereby affording storage to regulate their waters; the piercing of the narrow granite rim with a tunnel to divert the waters into Stave lake; and the installation of a generating plant at the outlet of the tunnel to recover the energy of the falling waters on their way to the lower levels of Stave lake, are the essential features of the Alouette project.

The waters thus diverted not only yield their energy at the new plant at the tunnel outlet, but, mingled with the waters of Stave lake, successively pass through the wheels at the Stave Falls plant, and, at a later date, through the proposed plant at Ruskin, thereby eventually yielding practically all the energy due to their drop from lakes to sea.

The watershed is in the main steep and rugged, barren and rocky in its higher elevations, but timber-clothed on its lower slopes. The region comprising it is unmapped, but its area is approximately eighty square miles; and the combined area of the lakes is about five square miles.

The flow of the Alouette river has been carefully measured since 1911. Studies of the mass diagrams compiled from the stream flow records extending from August 1st, 1911, to September 15th, 1924, indicate that with the storage of 170,000 acre-feet afforded by the Alouette dam there would have been available, during the thirteen years covered by the record, possible regulated drafts varying from 692 to 910 cubic feet per second.

As a basis of power development, it was assumed that there may be appropriated for power uses an average annual flow of 700 cubic feet per second, 90.2 per cent of the mean discharge, which may be drawn at varying rates to best suit the operating requirements.

Dam and Spillway

The dam consists of an earth fill of the semi-hydraulic type, with an exceptionally broad base and separate concrete-lined spillway. It is 65 feet high from the lowest point of the river bed and 1,030 feet long on the crest. Figures Nos. 2 and 3 show the general plan, section, and some of the details of the structure.

Strictly speaking, the site of the dam possessed few conditions to recommend it as a dam site. A profile along the axis reveals a trough-like depression some 150 feet wide and 35 feet deep, through which the river had its channel. The banks rise abruptly from the river and the trough is flanked on either side with gently rising terraces which merge into the steeper slopes of the adjoining hills. The entire area was covered with an exceedingly heavy forest growth. The west terrace is plentifully scattered with odd boulders, but these are rare on the east side.

The formation has the usual characteristics of the glacial outwash. Clays, intermingled with lesser or minor strata of silts, sands, gravels and boulders predominate in the river bed and the adjoining terraces.

This clay formation is remarkable for its resistance to erosion; in fact, it is the sole barrier that has held the lakes in being. Extensive borings were made of the sites of both dam and spillway. The clay blanket or barrier is eroded deeply in the channel, particularly at the downstream toe, where barely 10 feet of it remain in place. Under it lies a stratum of fine sands, silts and gravels, extending to a depth of over 100 feet.

To best meet the conditions imposed by the site, a dam of the earth fill type with exceptionally broad base and separate spillway was determined upon. The slopes of the dam are exceptionally flat, thus providing the broad base to reinforce and blanket the none-too-generous layer of underlying clay and affording conservative slopes for placing the clay fill, the behaviour of which, under the construction methods used, could not be definitely predicted.

The area occupied by the dam was cleared of timber and stumps and the thick forest floor removed. In addition, the central area, occupied by the core, was thoroughly stripped of top soil, so as to expose the surface of the underlying clay. Cut-off trenches were excavated in the clay to afford a better bonding between the underlying clay and the core material deposited upon it.

Practically all the material for the embankment was obtained from the spillway excavation. According to preliminary exploration and analysis, it would all be clay and would carry a very large proportion of fines. With these conditions in mind, the semi-hydraulic method of placing the fill was determined upon, in preference to the straight hydraulic method. The method used affords a much better control of the amount of water used and of the character of the material as deposited on the dam. If excavated hydraulically and pumped into the fill, an excess of fines was to be feared that would possibly have endangered the stability of the fill. The rate at which the embankment had to be placed to bring it to completion before the flood season left no margin for possible shut downs for draining out an unconsolidated fill.

All the material was excavated with steam shovels and drag lines, brought to the dam in dump car trains drawn by locomotives and dumped at or near the outer slopes. Hydraulic giants mounted at the top of the slopes attacked the dumps and washed the material inward toward the central pond. At the same time, a similar hydraulic monitor mounted upon a float in the central pool played upon the inner faces of the clay slopes, washing the finer materials down into the pool and leaving the coarser lumps lying on the slopes. The clay lumps proved remarkably resistent and did not break up to any great degree under the action of the nozzle streams. The benefit obtained was twofold; the limiting of the quantity of fines going into the puddle, and the affording of drainage for the central puddle core.

The employment of monitors for spreading the dump material proved most effective and economical, and had the distinct advantage of thoroughly working over with water all the materials going into the dam. Under the ordinary methods of semi-hydraulic filling by dumping from trestles or dry spreading, and with the hydraulic action on the inside slopes only, a considerable portion of the resultant fill is placed dry and remains so throughout the work, generally resulting in settlements and possible cracking of the slopes. By the method used at Alouette, this condition was entirely avoided. The settlements observed during the construction period and after completion were remarkably small.

Check elevations taken June 15th, 1925, on thirteen iron rods embedded in the fill before its final completion in January 1926 show a maximum settlement of 0.04 foot. Some difficulty was experienced, particularly at the higher levels, in holding the core pond to the limits of the specified width, which was, at any level, to be equal to the distance below the crest of the dam to that point plus 10 feet. The perfect control of pond level afforded by the method was of material assistance in regulating the width and consistency of the puddle mass.

The sluicing pond level was regulated closely to the requirements by pumping in through the dump monitors and pumping out with the floating pond monitor supplemented as required with a second floating pump employed exclusively for this purpose. A relatively deep pond was carried, generally 7 to 8 feet. All the material in the core area was thus deposited under water and the voids in the coarser materials forming the slopes at the edges of the core were well filled with fines.

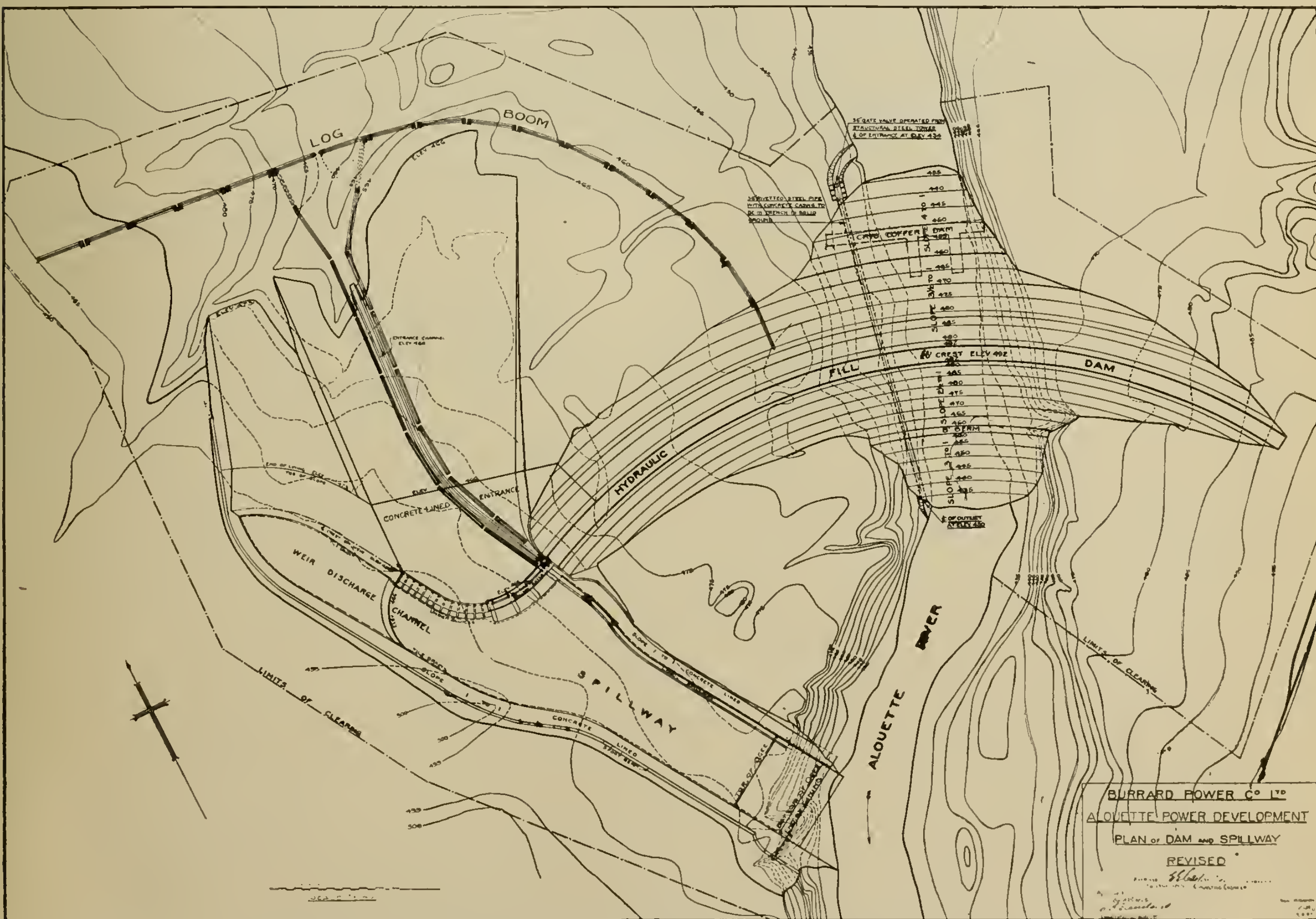
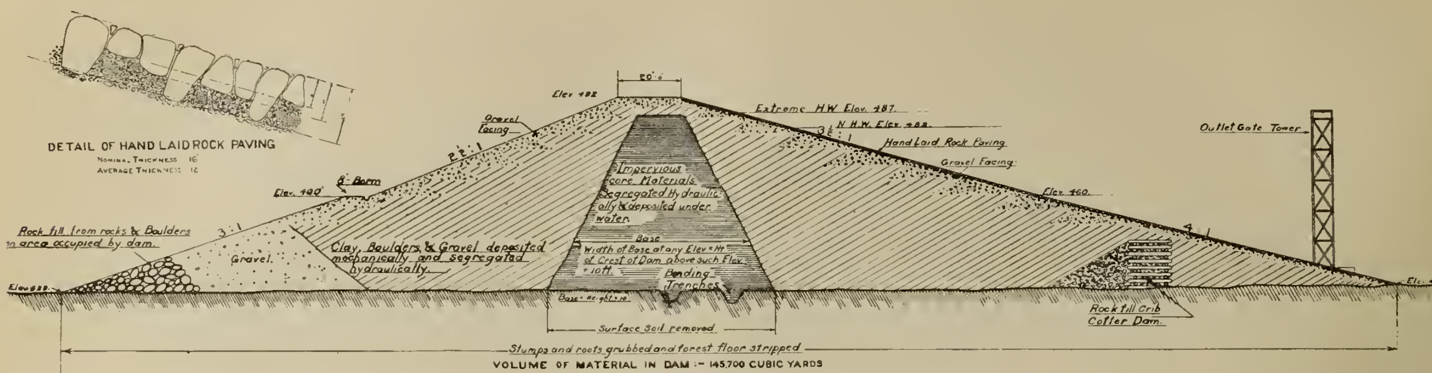
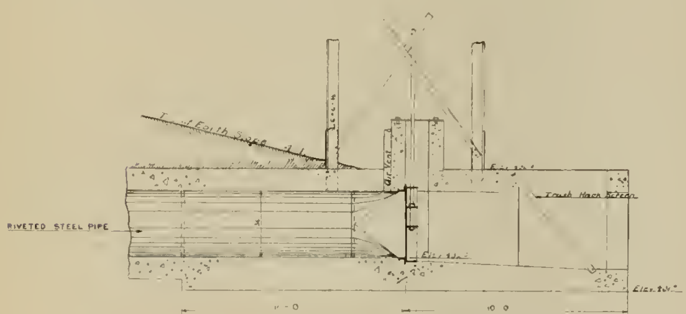


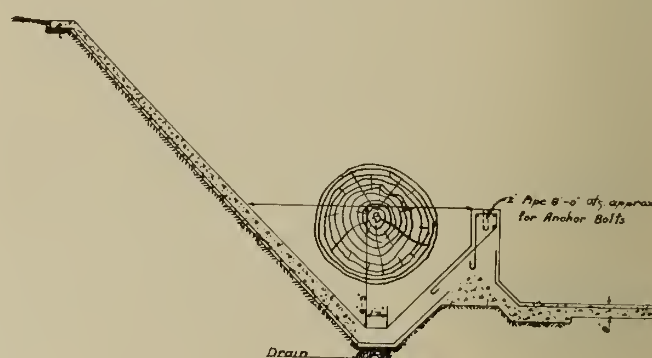
Figure No. 2.—Alouette Power Development—Plan of Dam and Spillway.



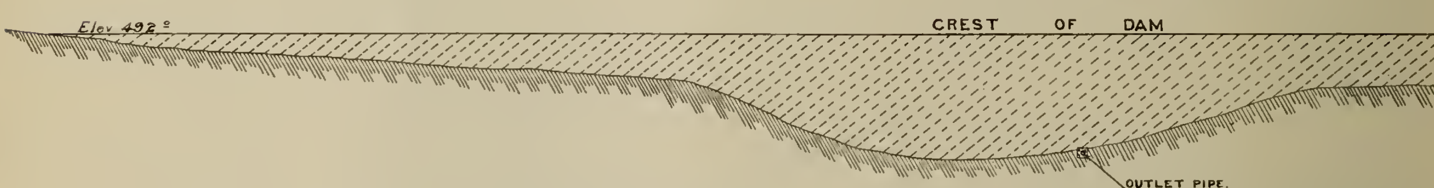
Cross-section of Dam.



Detail of Outlet Gate.



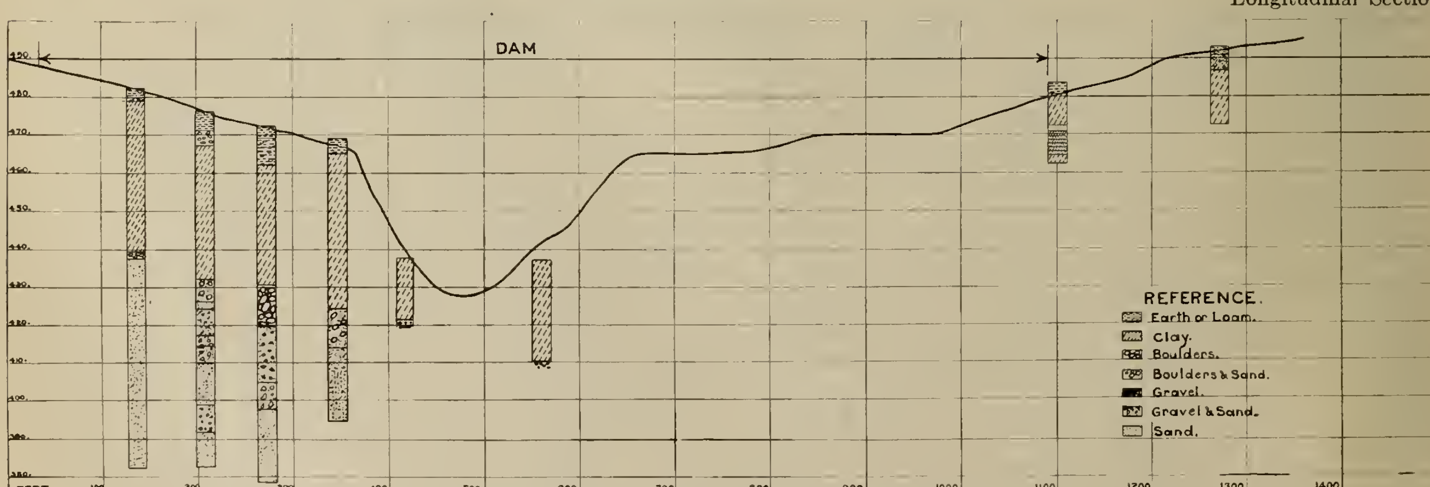
Enlarged Detail of Logway.



Longitudinal Section of Dam Developed

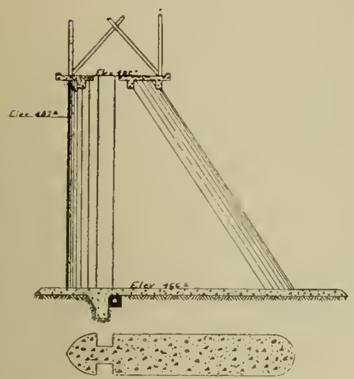
Under-sluice Gates.

Longitudinal Section

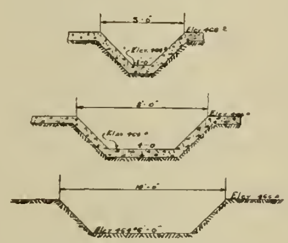


Log of Test Holes Along the Upstream Toe of Dam.

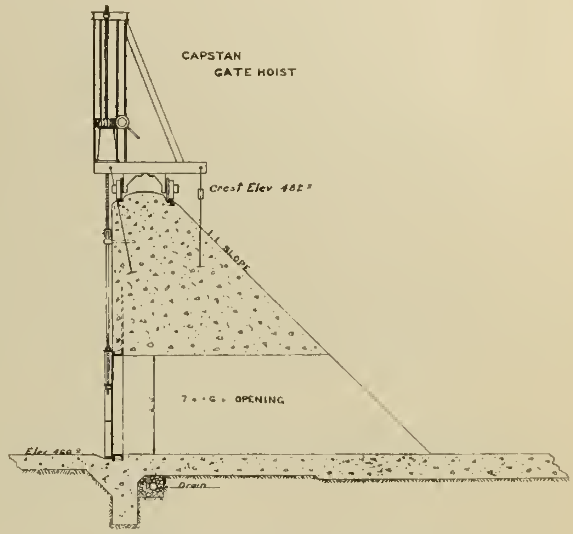
Figure No. 3.—Alouette Power Development—



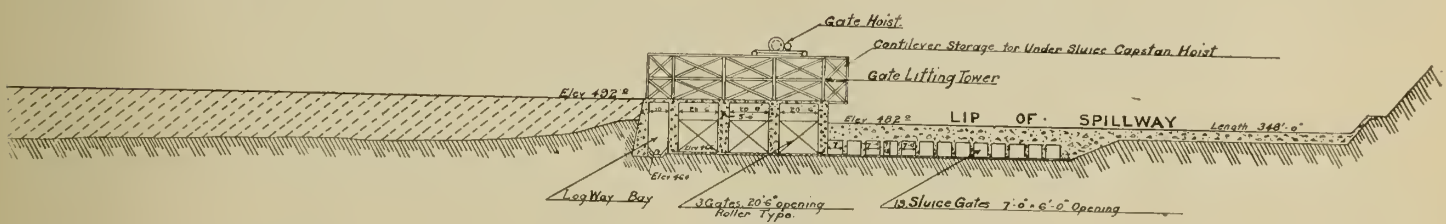
Plan and Elevation of Pier.



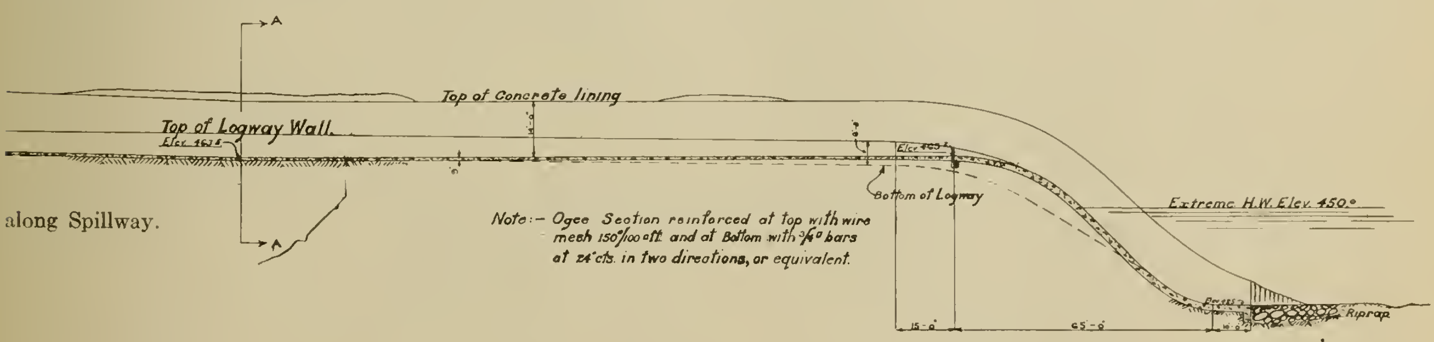
Channel Sections—
Entrance to Logway.



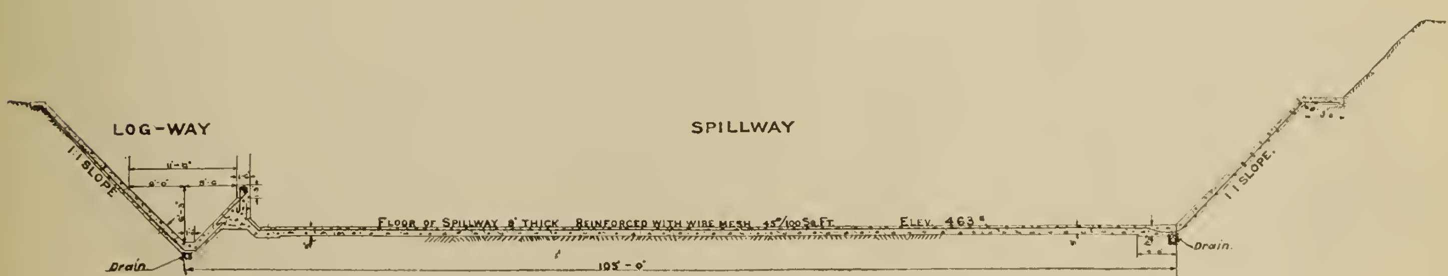
Section Through Under-sluices.



along Axis of Dam and Spillway.



along Spillway.



Section across Spillway at AA.

Sections of Dam and Spillway.

When the core reached elevation 482, the normal high water level of the reservoir, the pond was abandoned and the side embankments were brought on up by dumping and sluicing in with the dump monitors, all collected water being drained out continuously. The final topping of the crest to a depth of about 3 feet was made entirely of gravel dumped from a track laid along the centre of the crest.

As the dam reached the higher levels and the pond narrowed, some difficulty developed from the action of the nozzle streams in throwing large fragments of the broken-up clay over into the body of the puddle. The difficulty was entirely overcome by placing large vertical screens mounted on floats along the edges of the pond and directly in front of the dump monitors. These so effectively checked the streams that whatever burden of coarse materials they carried was dropped at the edge of the pond. The screens were cheap and simply constructed and easily moved from place to place. They were built in units about 40 feet long by 10 feet high and consisted of one-inch mesh chicken wire backed with 6- by 6-inch reinforcing mesh mounted upon a light timber framework supported and floated by two cedar logs. A screen was provided on either side of each float to permit its use on either side of the pond simply by moving it laterally across the pool.

Samples of core material for analysis and penetration tests with 6-inch cast iron ball were taken weekly. Two typical analyses of samples of core material are given below:—

	Sampled Aug. 9th Elevation 444 Ball penetration 10 feet per cent.	Sampled Sept. 7th Elevation 461 Ball penetration 0.8 feet per cent.
On 100 mesh	6.84	3.62
200 mesh	4.72	3.05
Diameter of particles, mm....		
0.075 to 0.050	18.50	28.67
0.050 to 0.025	13.75	14.16
0.025 to 0.010	23.65	20.71
0.010 to 0.005	20.04	25.92
Less than 0.005	12.50	3.87

The diversion of the Alouette river during the construction of the dam was made through the Alouette tunnel, which was not sufficiently completed for this purpose until June 17th, 1925. The coffer dam was closed on June 21st, but the stripping of the foundation in the river bed delayed the major filling operations until July 13th. On October 30th, the embankment had reached elevation 485 and the spillway had progressed sufficiently to remove the danger of damage from flood. Progress thereafter was slower, due to trimming and finishing both the embankment and the spillway.

The maximum progress was made in September, when 35,070 cubic yards of embankment were placed in 25 days of two 8-hour shifts. On the best two-shift day, 1,954 cubic yards were placed. All the excavated material had to be loosened with powder for efficient digging with the excavating machines.

The quantities involved in dam are:—

Clay from spillway excavation	93,000	cubic yards
Clay from borrow pit	15,000	" "
Gravel facing	29,770	" "
Cofferdam embodied in main dam	1,850	" "
Rock paving	3,380	" "
Total	143,000	" "

Owing to a tendency of the clay material to disintegrate if allowed to dry and subjected later to wetting. a gravel cover 2 feet in thickness was laid on both slopes and the crest of the dam. This cover acts as a mulch to keep the underlying clay constantly moist. The entire upstream slope was paved with hand-placed rock obtained from quarries up the lakes and transported in scows to the dam. The specifications called for rock paving varying from 11 to 16 inches in thickness with an average thickness of 12 inches, but the paving as placed averaged considerably thicker.

A separate concrete-lined spillway with control gates and overflow weir carries the flood waters around the westerly end of the dam and conducts and discharges them into the river some 200 feet below the downstream toe.

The dimensions, slope and hydraulic characteristics of the spillway structure afford a safe outlet for 30,000 cubic feet per second of flood water. The greatest recorded flood of the river occurred in October 1921, when the peak discharge, of short duration, amounted to 15,000 cubic feet per second. The normal maximum yearly flood discharge is 6,000 to 7,000 cubic feet per second.

The design of the spillway was influenced by necessity of meeting the requirements of timber interests operating or owning timber above the dam, for passing logs, shingle bolts and other forest products through the spillway and splashing or floating them on down the river.

The approach is of ample proportions to insure low velocities which will not damage by erosion the unlined portions. As these velocities build up, a concrete lining of sides and bottom is provided for both the entrance apron and the spillway proper; the side linings average 14 feet in height and extend well up the sides to an elevation 2 feet above the highest water level.

The drop of the water from the spillway level down to the stream bed, a distance of about 38 feet, was accomplished by an ogee section at the end of the spillway. The excavation was shaped to the required form and a reinforced-concrete covering, consisting of longitudinal and transverse ribs with a 15-inch slab, was placed directly on the excavated surface of the clay.

The safeguarding of the foot of the ogee structure against erosion was something of a problem, since, at the lower levels, the capping of hard clay had been cut through and the material encountered below was a mixture of fine sand and clay,—a material very susceptible to erosion. The flat discharge section at the end of the ogee structure is depressed below the river bed so that at all stages of discharge the backwater forms a pool of sufficient depth to induce an hydraulic jump. This was relied upon to dissipate to a considerable extent destructive water velocities. At the lower end a concrete cut-off toe wall 5 to 7 feet in thickness was carried to depths of 12 to 15 feet below the ogee floor. This toe wall was also carried back under each side of the ogee a distance of 19 feet, thus forming a deeply-founded, U-shaped spigot protecting the entire end of the ogee structure.

As a further protective measure, a flexible mattress, 40 feet in length and flaring from 120 to 145 feet in width, was placed beyond the toe wall. This mattress was formed of very large boulders, specified to have a minimum diameter of 3 feet. Eyebolts were anchored in the top of each boulder and all were securely tied together with longitudinal and transverse cables intersecting at the eyebolts and securely clamped to them. Over the tops of the boulders a 12-inch slab of concrete, encasing the cables and eyebolts, was poured. Beyond the mattress a loose riprap of heavy boulders was placed along the rising slope leading to the stream-bed level. At the sides steel sheetpiling was driven to afford in emergency, temporary protection against undercutting.

When discharging its full capacity of 30,000 cubic feet per second, the water in the spillway will be approximately 12 feet deep and will flow at the rate of 20 feet per second.

The control of the spillway is effected by three crest gates and one shingle bolt or log bay, supplemented by a free weir having an effective crest length of 348 feet, into which are introduced thirteen under-sluices to permit the increase of flow of water for log splashing at lower lake levels. A flood of the proportions of the maximum accorded flood of 1921 would be amply taken care of by the free weir, which will be topped by 5 feet of water at extreme high lake level at elevation 487. With lake level at 487, the combined discharging capacity of the log-way, crest gates and weir section is approximately 30,000 cubic feet per second.

The three crest gates, of the Stoney Roller type, 20 feet 6 inches in width by 18 feet in height, are set between massive concrete piers. A steel superstructure supports the operating hoists by which the gates are raised or lowered, normally by motor-driven winches, but, in emergency, by hand power. The sills of the spillway crest gates are at elevation 466, 16 feet below the normal high lake level.

The log chute bay, 10 feet in width, is adjacent to the east abutment of the spillway and is closed with heavy timber stop logs. Its V-shaped bottom is 2 feet lower than the sills of the adjacent roller crest gates, and is extended upstream through the entrance apron to afford greater facility for passing shingle bolts at low water stages. On the downstream side of the log bay and extending the full length of the spillway, the log chute is formed by setting a heavy concrete wall parallel to the easterly side of the spillway, thus forming a V-shaped channel 11 feet wide at top and 6 feet deep between the wall and the side lining of the spillway, through which timber products may be passed from lake to river.

The under-sluices are designed to interfere to the least extent possible with the flow of water over the weir crest. They are of the sliding face cast iron type, 6 by 7 feet opening, and are provided with short stems which do not extend above the weir crest level. There will be no occasion to open these sluices when the water level is topping the weir, hence the operating head will never exceed 16 feet above their sills. The sluices are raised and lowered by a moving capstan hoist travelling upon rails set in the concrete weir crest. The capstan is removed from the crest and stored during the high water season.

A 36-inch steel outlet pipe, set in concrete and with valve and structural steel operating tower, is provided to release water for domestic and agricultural purposes at the lowest stages of the lake.

About 8,000 cubic yards of concrete were used in the construction of the dam, the greater part of this being in linings 6 to 15 inches thick in the spillway cut. The concrete aggregate was obtained from the gravel bank that supplied material for the gravel facing of the dam.

The side linings of the spillway lie on a 1:1 slope and average about 14 feet high. As a means of holding down

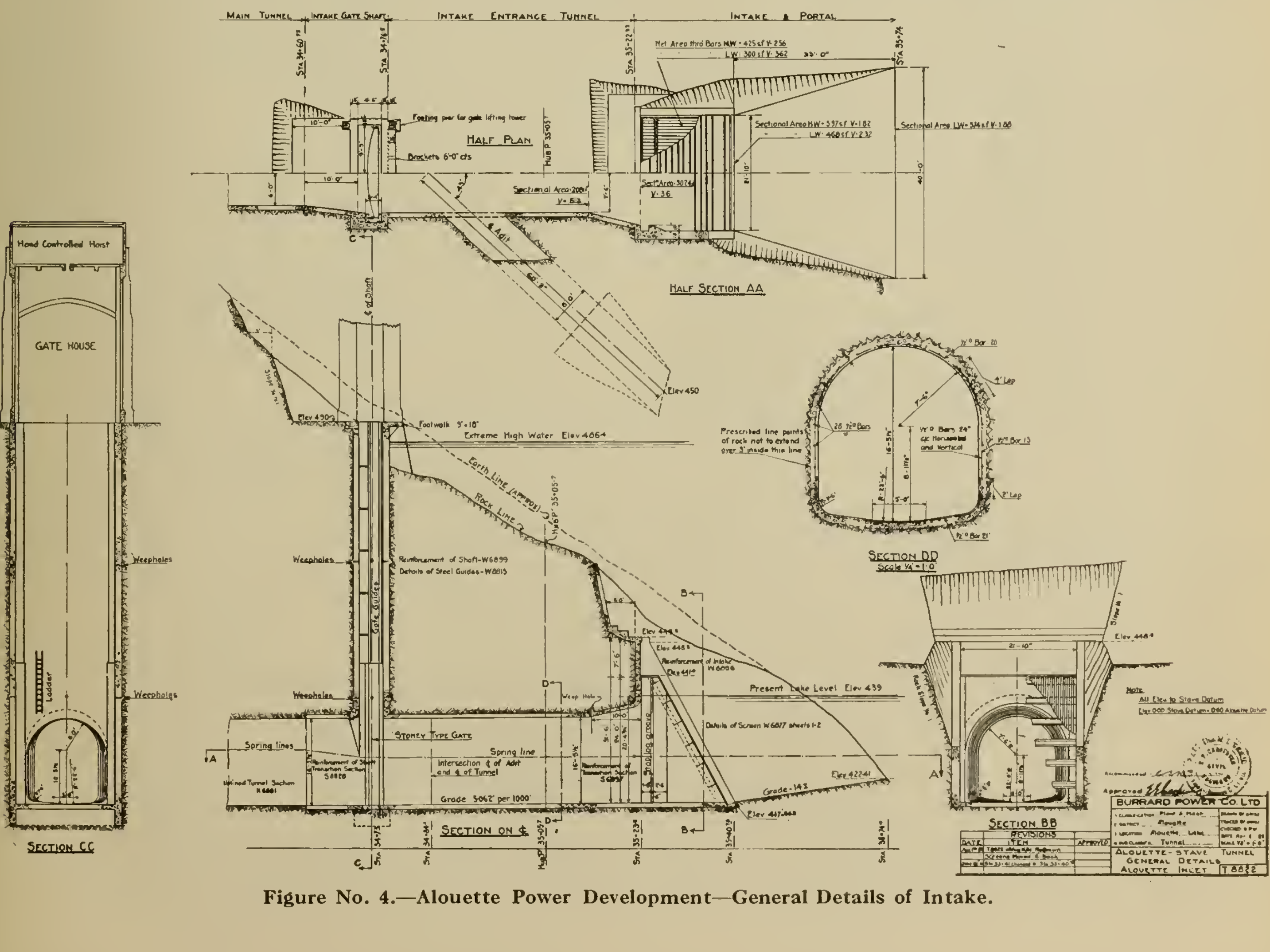


Figure No. 4.—Alouette Power Development—General Details of Intake.

Figure No. 5.—Alouette Tunnel Intake—View from Lake.

the forms against the uplift of the concrete on this slope, concrete ribs spaced 14 feet 3 inches, centre to centre, were first poured and allowed to set and then the forms for the lining were anchored to them. The ribs were of inverted T-section, 12 inches deep and 14 inches wide, including a 2-inch shoulder on either side to receive the slab forming the lining. The lining slab was 12 inches thick at the bottom, decreasing to 9 inches at the top, while the rib was 12 inches deep throughout. Expansion joints were placed at alternate ribs.

The spillway floor, 9 inches thick, was poured in alternate blocks about 20 by 30 feet in size. Expansion joints consisting of ¼-inch sheets of asphalt and asbestos fibre compound were placed between blocks. Both side and bottom linings were reinforced with 6- by 6-inch No. 5 welded wire mesh, the reinforcement being carried through the expansion joints.

Alouette Tunnel

From Alouette portal and intake, on the westerly shore near the upper end of the upper lake, the tunnel extends in an easterly direction for 3,539 feet before reaching the head gate of the short penstock leading to the power house.

The intake, which is depressed 19 feet below the low water level of the lake to afford full draft at this stage, is provided with screens and stop logs set in a heavy concrete structure. A short section of tunnel, 46 feet long, leads to the intake gate shaft, which extends upward through solid rock to the surface of the mountain side. The shaft head is at elevation 490, and is 3 feet above extreme high water level. A heavy control gate of the Stoney Roller type, 18 feet wide by 15 feet high, closes the tunnel at the bottom of the shaft, its operation being accomplished by means of a powerful hand-operated hoist set in a gate tower at the shaft head. The shaft, entrance tunnel and intake are lined with reinforced concrete 9 to 15 inches in thickness. For general arrangement and details, see figure No. 4. A photographic view of the intake and gate tower is shown in figure No. 5.

The main tunnel, exclusive of entrance section and adits, is 3,485 feet in length; straight in alignment and has a uniform grade of 5.062 feet in 1,000 feet. In section, it is an arched rectangle 12 by 16 feet. The data for the normal unlined section are:—

Area inside prescribed line	178.5	sq. ft.
Excavation inside prescribed line (per lin. ft.)	6.61	cu. yds.
Hydraulic radius	3.58	ft.
Co-efficient of roughness—Kutter formula (n)	.032	
Discharge $Q =$ 700 c.f.s., velocity	3.92	ft. per sec.
hydraulic slope	.00128	
Discharge $Q =$ 1080 c.f.s. velocity	6.09	ft. per sec.
hydraulic slope	.00308	

The tunnel bore traversed in the main a solid granitic formation affording excellent stability of section and good drilling and breaking qualities. At frequent intervals, fractures or seams, heavily water bearing, were encountered but these were of little consequence except as a matter of the minor delay and inconvenience attending them. Only one major break in the formation was encountered. Approximately 700 feet from the Stave portal an extensive and troublesome mud seam or fault zone was encountered which necessitated the setting of nearly 100 feet of heavy permanent timbering before it was traversed. The progress of the work was delayed some three weeks on this account. The timbered section and an equal length of rock section adjoining it were lined with a heavy lining of concrete before water was turned in.

The tunnel proper terminates at the penstock gate shaft, 14 by 15 feet in size, which rises 85 feet through solid rock from the surge chamber floor to the surface of the hillside.

In order to gain access to the main tunnel at the Stave portal, an adit tunnel 8 by 10 feet in section was driven from the hillside somewhat south of the line of the main tunnel, to the gate shaft. In addition to its function as a construction agency, the adit serves as a by-pass for draining the main tunnel and for drawing water from Alouette lake into Stave lake in case the Alouette plant is shut down. A 6 by 8 feet sliding cast iron Coffin type gate with bronze facings is set in the gate shaft at the head of the adit for controlling its flow.

The penstock head gate is of the caterpillar self-closing type, 13 by 14 feet clear opening, with motor hoist and remote control. The maximum head is 88 feet above its sill.

A concrete gate tower conforming in architecture to the power house surmounts the shaft and houses the hoisting equipment for the two gates and for the screens. The structure is carried on high columns to afford headroom for hoisting the gates and screens clear and to allow the surge overflow to discharge freely. The arrangement of penstock shaft and gates is shown in figure No. 6.

Immediately back of the penstock gate shaft a tapering vertical enlargement of the tunnel was excavated in the rock. This, in combination with the penstock gate shaft, forms the surge chamber designed to meet the hydraulic conditions imposed by variations of load on the turbine and the consequent variations in rates of flow in the tunnel.

The combination of shaft and enlarged tunnel form of chamber results in something of a differential action, in that the area of the chamber increases with the falling water levels, with the result that, when there is an increased demand for water to supply the penstock, the water level

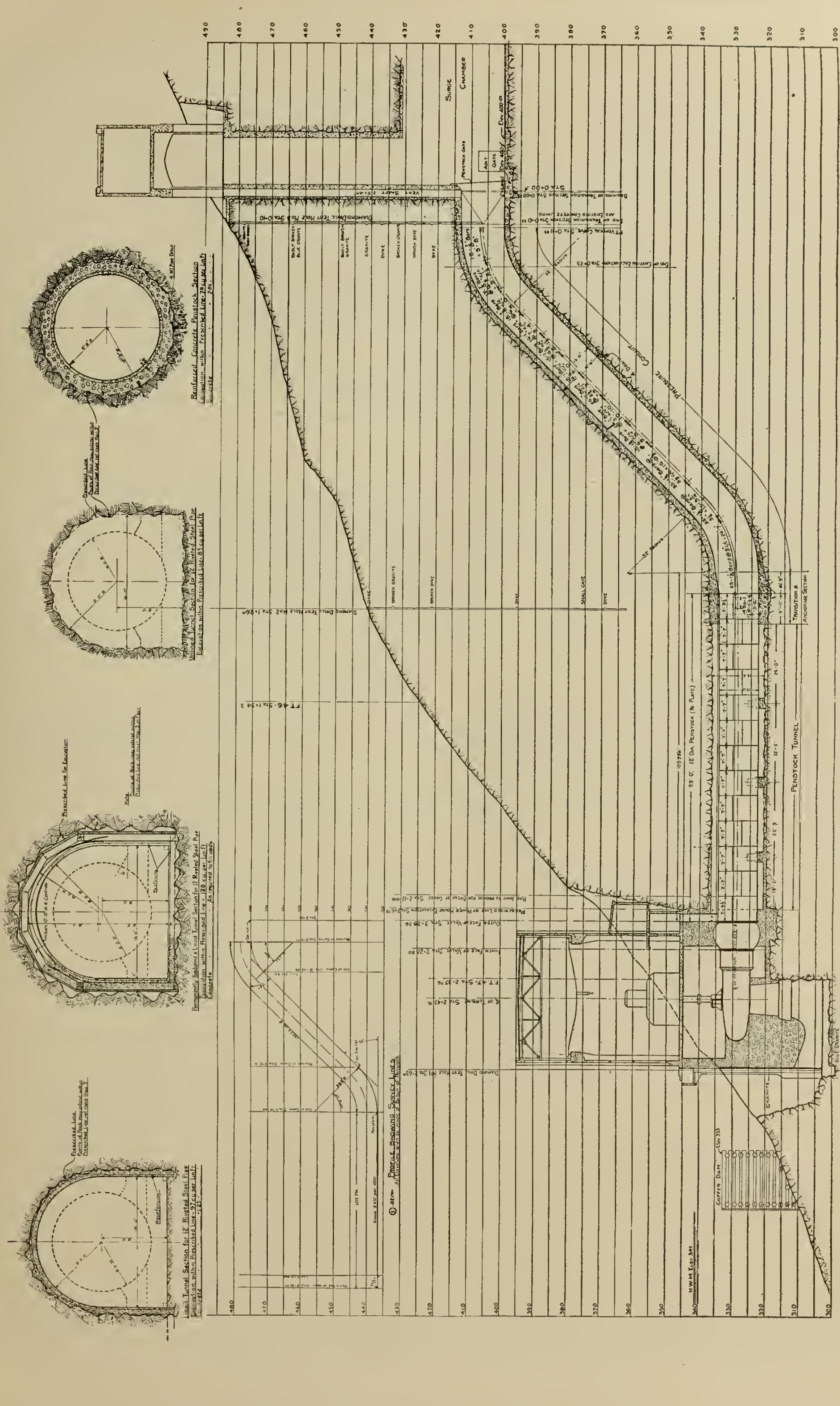


Figure No. 6.—Alouette Power Development—Section of Tunnel Outlet, Penstock and Generating Station.

in the surge chamber drops rapidly at first, thus quickly accelerating the flow in the tunnel and at the same time providing in its lower levels a proportionately greater storage of water to supply the deficiency in the penstock. The necessity of meeting the condition of low level in the surge chamber due to the Alouette storage being drawn down to 437 was an important influence in the design. This latter condition requires the effective storage capacity of the surge chamber to be concentrated at elevations below 437.

The design, as shown in figure No. 7, is calculated to permit the rejection of full load and the consequent shutting off of all the water at the turbine in 2½ seconds without damage or disturbance other than a waste of water for half a minute's time from the overflow basin at the top of the shaft; similarly, the turbine may be started from dead stop and brought to full steady load in 75 seconds, and from half to full steady load in 10 seconds without drawing the water in the chamber to a dangerous level or causing surge fluctuations of a dangerous nature.

While these conditions would probably not afford the best commercial regulation under rapidly fluctuating loads, if the plant were operating alone, this is not essential as the Alouette plant is small in comparison with the remainder of the system and will operate in parallel with the other plants amply capable of taking care of the situation.

Work of driving the adit on the Stave side was started July 9th, 1924, and work from the Alouette side was started October 10th. The two headings met May 26th, 1925, at a point 2,522 feet in from the Stave shaft.

In excavating for the Alouette portal and intake, a rim of rock was left between the excavation and the water line of the lake. This was drilled from the excavated face with holes inclined downward and also with a row of 20-foot holes from the top at the water's edge, inclined out toward the lake. Before shooting this rock rim, stop log timbers were put in place across the entrance to the tunnel and the steel trash racks were set, then covered with a barrier of hemlock logs, 12 to 18 inches in diameter, placed side by side vertically. Outside of the logs a layer of baled straw was placed as a cushion. The holes were loaded with a total of about 800 pounds of powder, there being some 500 cubic yards of rock to break up. In spite of all these precautions the shot, kicking back directly toward the tunnel, broke through the barrier and destroyed the screens, supporting beams and stop logs and admitted the water to the tunnel some four or five days before it was planned to do so. No other damage of consequence was done, but some considerable difficulty was experienced in closing off the water again to replace the damaged members and complete the concrete work.

Penstock

The tunnel proper terminates at the penstock gate shaft where the caterpillar gate controlling the flow through the penstock is set. The penstock continues on in tunnel some 250 feet further to the power house. As a consequence of its short length, loss of head had little influence on its design, the limiting conditions being rather the choice of a

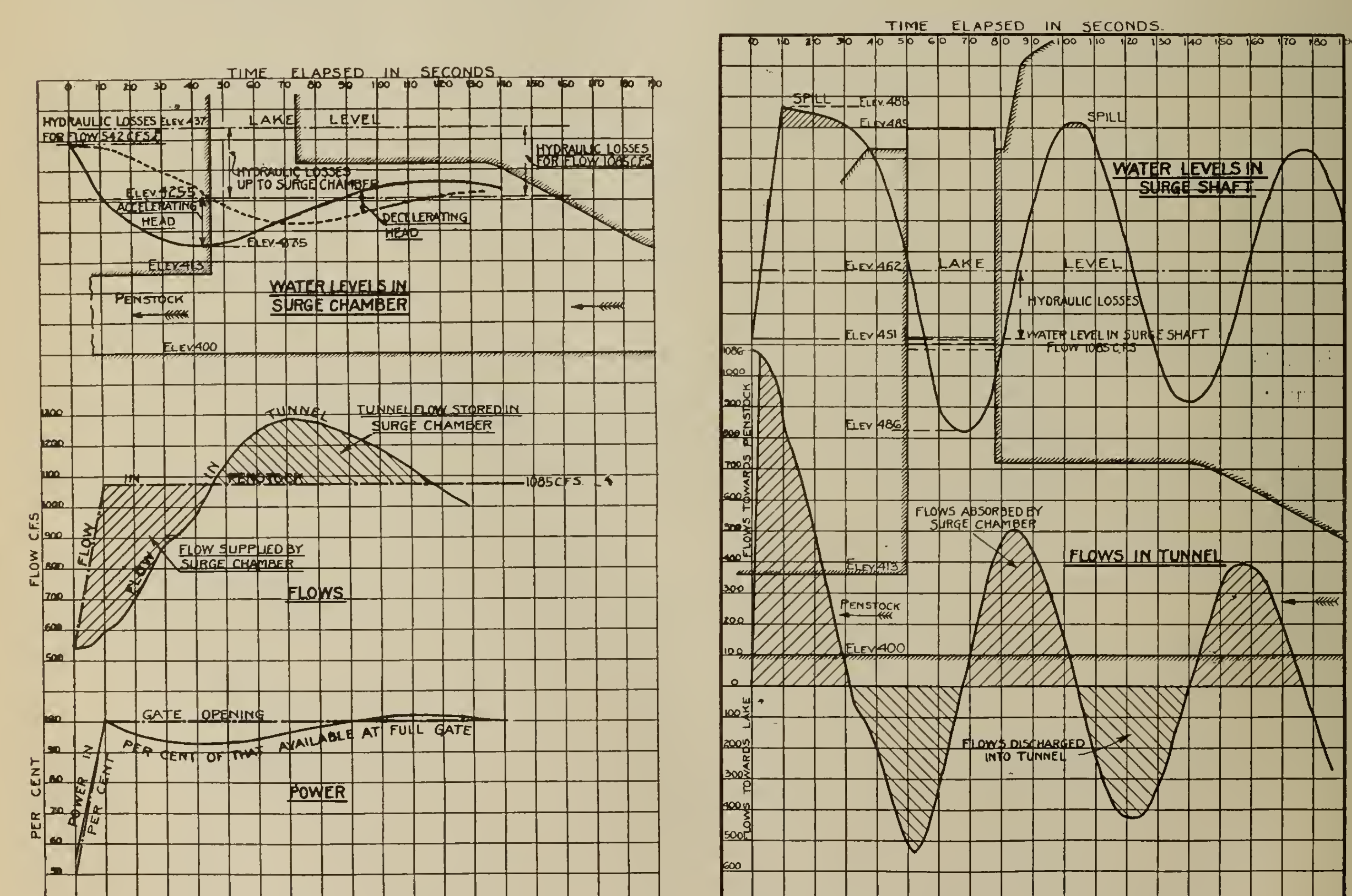


Figure No. 7.—Alouette Power Development—Surge Temperature Graphs of Surge Conditions. (1) Surge conditions with gate open half to full in ten seconds. (2) Surge conditions with flow of 1085 c.f.s. and gate closing in two and-a-half seconds.

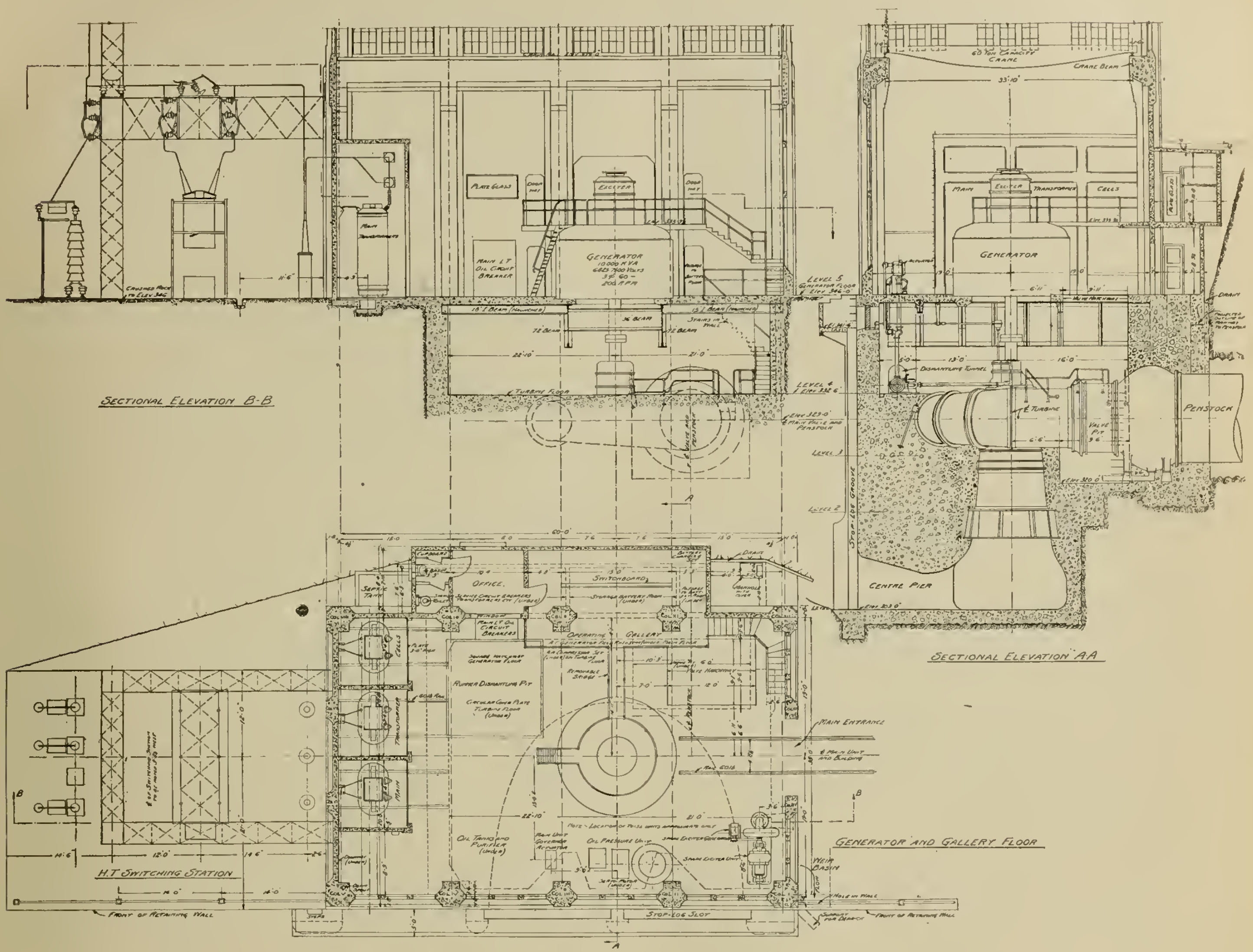


Figure No. 8.—Alouette Power Development—General Layout of Generating Station.

diameter to afford permissible velocities in terms of pressure rise under consistent regulation.

A sectional view of the penstock and its relation to the tunnel, surge chamber and turbine is shown in figure No. 6.

The upper portion is designed as a pressure conduit or pressure tunnel 13 feet inside diameter, lined with concrete 15 inches thick and reinforced to withstand the total head, including pressure rise, without stressing the steel reinforcement beyond its elastic limit. The rock cover theoretically and under ideal conditions affords sufficient backing to take up the thrust due to water pressure, but after due consideration and taking into account the actual conditions of rock structure and the probability of not being able by the best workmanship and inspection to actually meet ideal conditions, it was decided to provide the reinforcement.

At the lower end of the pressure conduit the change in diameter from 13 to 12 feet is accomplished in the transition section heavily lined with concrete similarly reinforced.

The lower section, 99 feet in length, is a steel pipe line 12 feet in diameter, laid in an open tunnel and supported and anchored in concrete piers. The tunnel is unlined except where rock structures may require lining.

The entire pipe line is of $\frac{5}{8}$-inch steel plates in parallel courses with lap joints triple riveted on the longitudinal and double riveted on the roundabout seams.

Power Station

The power house is set in the steep rocky hillside adjoining the west shore of Stave lake, some $10\frac{1}{2}$ miles north of Stave falls, the only approach to it being by water from Stave falls. The station, in section, is shown in figure No. 8. The building, as designed, is of reinforced concrete construction, massive but pleasing in appearance. On the south side adjoining the building, a level space 40 by 40 feet is provided as a switch yard and at the north end a similar space 30 by 100 feet forms a material yard. Both spaces are formed at the expense of considerable rock excavation and concrete retaining walls along the lake shore.

The main building covers an area 64 by 41 feet, is 50 feet in height, and contains the single vertical 12,500-h.p. hydraulic turbine direct-connected to a 10,000-kv.a. alternator, with direct-connected exciter, a turbine-driven spare exciter, low tension oil circuit breakers, and the step-up transformers. The usual auxiliaries including governors, governor oil pumps, field rheostat for the alternator, oil-purifying and handling outfit for lubricating, transformer, and circuit-breaker oils, and general service equipment, sump pumps and air compressor, are also housed in the building. A leanto adjoins the main building and lies between it and the hillside. The leanto houses the main switchboard, control storage battery, low tension disconnecting switches, and other auxiliary electrical equipment. The main floor elevation of the power house is at elevation 346; the leanto floor at elevation 355.75, and the turbine floor at elevation 332.

Beyond minor soil stripping, all the excavation for the building and machinery foundations is in solid rock. The draft tube and tail race excavation extends down to elevation 301, some 39 feet below the high water level of Stave lake. Some 6,000 cubic yards of rock are involved in preparing the foundations.

A concrete weir, 100 feet long, with crest elevation at 314, will control the tail water, the normal low level of which is 316.

To hold out the waters of the lake, which will rarely drop as low as 316, during the construction of the foundations a heavy cofferdam of rock-filled log cribs with timber sheet piling facing and completely enveloping the front of the building and the weir, has been constructed. The top of the coffer dam is at elevation 333, below which level the waters of the lake are being held until the front wall of the building shall have been poured to floor level. The tail race bays will then be closed with stop logs and the coffer dam will no longer be required.

An electrically operated bridge crane of 60 tons capacity will be provided for service inside the building. A 30-ton steel derrick is provided for handling heavy parts and materials from scows to station yard. The derrick has a special setting at the building corner, the walls being specially designed to function as stiff legs for its support.

In the switch yard adjoining the building on the south will be mounted the 60,000-volt line oil circuit breaker, disconnecting switches, and lightning arrester equipment. A simple steel structure is provided for mounting disconnecting switches, and terminating the transmission line that connects this station with Stave falls.

The station building and appurtenant works are now under contract and the work is proceeding satisfactorily. The major part of the rock excavation both for the building and machinery foundations and for the pipe line tunnel and pressure conduit is completed.

To control the supply of water to the main turbine from the penstock, there is provided a main valve of the balanced cylindrical type. It is 15 feet long, has a maximum body diameter of 17 feet, with inlet and outlet diameters of 12 and 8 feet respectively. It is hydraulically operated, designed for remote automatic control, actuation being accomplished electrically or in emergency by hand.

The main turbine is a vertical shaft unit of the Francis type, developing 12,500 h.p., effective rated output under 125.5 net effective head, running at 200 r.p.m. The spare exciter turbine is a horizontal shaft reaction unit of 150 h.p., running at 900 r.p.m.

Governing equipment for the main unit consists in general of actuator, servo-motor, and oil pumping unit. The oil pumping unit is driven by both hydraulic turbine and electric motor, a constant pressure of oil for operation of turbine gates being thus assured. The governor is arranged for both electric and hand control.

The alternator is a vertical shaft unit with revolving field rated at 10,000 kv.a., and designed to operate at 80 per cent power factor, 6,827-7,500 volts, 3-phase, 60-cycle, 36 poles, 200 r.p.m. The rotor is designed to withstand 100 per cent overspeed. Brakes operated by air pressure are provided to bring the rotor quickly to rest on all occasions of shut-down.

Both main and spare exciters are of 119 kw. capacity, with nominal voltage rating of 250. The former is of vertical shaft type with its armature mounted on an extension of the alternator shaft; the latter is a horizontal unit direct connected to a hydraulic turbine mentioned previously.

Three transformers now on hand, which are conservatively rated at 3,000 kv.a., will be used to step up from alternator voltage of 6,827-7,500 to transmission voltage of 60,000-66,000. They are indoor type, water-cooled and consequently have been given an inside setting. A spare unit will be available.

While the last details of the switching and control equipment are not yet decided upon, the plant as designed may be termed a *full-automatic* station, with, however, the single reservation that the manually operated starting and stopping indications will be given at Stave falls generating station.

The starting indication is given when the station operator at Stave falls closes, at that station, the oil circuit breaker in the transmission circuit connecting Alouette and Stave falls. Energy is thus made available at Alouette and a master starting device is energized and commences to function and, providing correct starting conditions exist, the penstock valve is opened, the turbine gates start to open and the rotor is set in motion; as the speed increases the exciter voltage is built up, and when this voltage reaches the proper point a contactor closes, applying exciting current to the alternator field; as synchronous speed approaches, an automatic synchronizing device takes hold, and when the required conditions of speed, voltage and phase relation are reached it closes the low tension oil circuit breaker, thus connecting the alternator to the transmission system. The machine then assumes load in accordance with the governor setting.

When a stopping indication is given at Stave falls by opening the line oil circuit breaker, loss of load causes certain devices to function and the penstock valve closes; at the same time the governor closes the turbine gates; at the running light position the alternator is disconnected from the line, field excitation is removed, and the brakes are applied and the machine comes to rest.

Complete provision, as in all automatic stations, will be made to prevent starting or shutting down if abnormal conditions develop. Provision will also be made for full manual operation of the station if desired.

All the hydraulic equipment and the main generator, exciters and their auxiliaries are in the course of manufacture by the English Electric Company, Limited, of London, England. Deliveries are expected in the early spring of 1926.

The switching and control equipment is being designed and manufactured by the Canadian General Electric Company, Limited. Particular study and attention is being given to the automatic features.

Transmission Line

The current from the Alouette station is transmitted to Stave falls, where it is fed into the high tension buses for transmission to system load centres. The line was built in 1924 to furnish construction power for the tunnel work. It is 10½ miles long, of the single cedar pole type, carrying one 3-phase, 66,000-volt power circuit, and one telephone circuit.

The Stave Falls Development

The initial development of the Stave falls project was undertaken and carried to completion in 1911 by the Western Power Company of Canada, Ltd., then, and until 1921, a competitor of the British Columbia Electric Railway Company. At the latter date the control of the Western Power Company of Canada was acquired by the British Columbia Electric Railway Company, which has since improved and added to the plant the features described in some detail in this paper.

The initial installation consisted of the intake dam, the sluice dam and the Blind Slough dam,—all raised to a height to permit storage in the lake to elevation of 318,—control works and penstocks for four 8,825-kv.a. generating units, three of which were installed.

The improvements and additions undertaken in 1922 and completed in 1925, included as a first step the installation of the fourth generating unit, followed by the raising of the intake dam, the construction of the west wing wall, the Blind Slough dam, and the filling in and raising of the sluice dam, all to a level to permit storage to be carried to elevation 340,—a net raise of 22 feet in the former storage level,—and the installation of a fifth generating unit with the necessary penstock, extensions in power house building, tail race, etc.

Stave lake as it stands today, with its water level at elevation 340, (269 feet above mean sea level), is a beautiful body of water some 17 miles in length and 1½ miles in width, lying 35 miles east of Vancouver and, with the upper river feeding it and the lower river joining it to the Fraser river at Ruskin, forming a drainage system some 60 miles in length. The original lake terminated about 7 miles above the falls, where the plant is built. The river at this point separated into two channels forming an island between them and dropped over a series of falls some 80 feet.

The intake dam, power house and tailrace occupy the westerly channel, and the sluice dam or main dam the easterly or main channel. A quarter of a mile further east and separated from the main channel by a high rocky hill, is a third channel known as the Blind Slough. This latter channel is some 20 feet higher than the others and did not function as an outlet, but was closed by ancient log jams and beaver dams, hence its name. The Blind Slough dam now closes this old channel, which is used to carry away the flood overflow from the lake. Figure No. 9 shows the general location of the plant with reference to the topographic and surface features.

The watershed of the Stave river, like that of the Alouette, is largely unsurveyed and unmapped, hence its area can only be given in approximate figures as 450 square miles.

The watershed lies on the westerly slope of the Coast Range mountains; the lower part, extending from the dam half way up the lake, rises to a maximum altitude of 4,000 feet, and is, in the main, heavily timbered. Beyond this point the mountains rise more abruptly to heights above the timber line, the topography becomes more broken and rugged, and perpetual snow fields and small glaciers occupy a considerable part of the area. The principal peak of the watershed, Mount Baldy, stands near the head of the lake and rises to an altitude of over 6,000 feet.

The Stave lake basin is clearly of glacial origin, the receding glacier having formed a series of morainal dams, the remnants of which, combined with occasional spurs of bedrock, form the barrier that holds the lake in place. These dams have been eroded away by stages, and the present river valley, with its terraced flanks and occasional gorges, has been cut deeply into the stranded remnants of the bedrock that withstood the grinding glacier but have proved a futile barrier to the gentler but persisting action of the stream.

The average annual precipitation for the 15-year

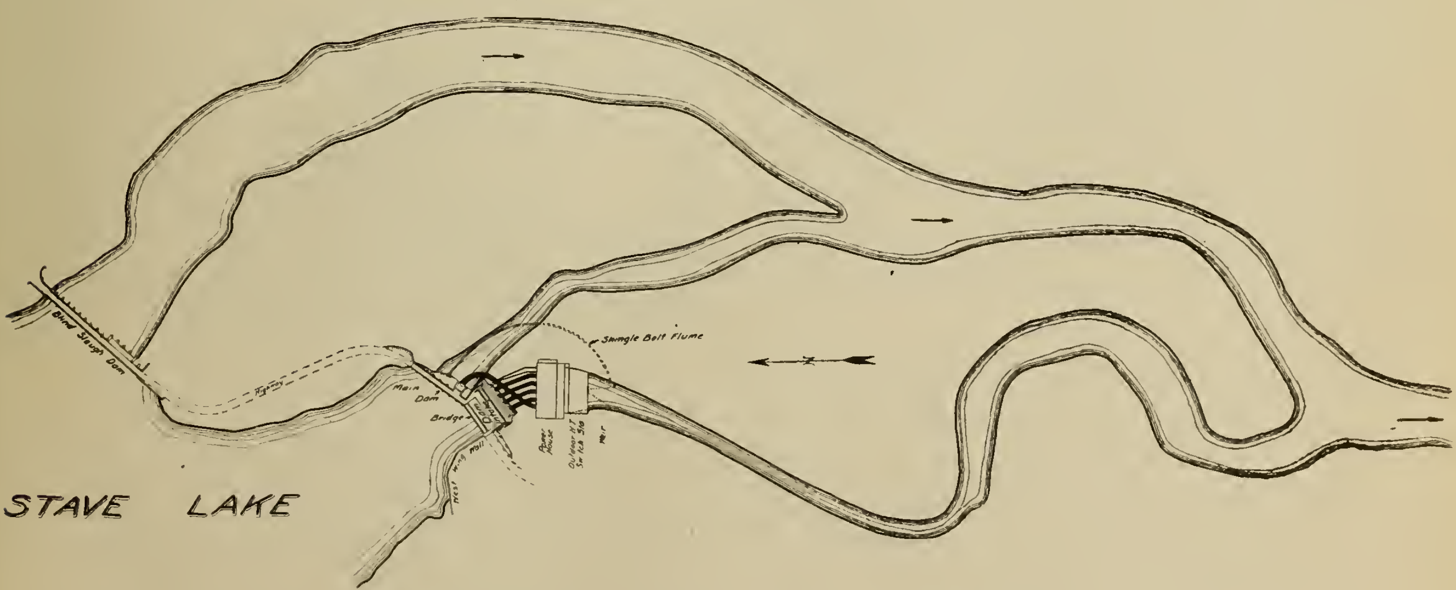


Figure No. 9.—Stave Falls Power Development—General Layout.

period 1910 to 1924 inclusive, as recorded at the observing station at Stave falls, is 78.3 inches, which is made up of monthly averages as follows:—

Jan.	10.4 inches	May	4.21 inches	Sept.	5.24 inches
Feb.	6.64 "	June	3.69 "	Oct.	8.22 "
Mar.	7.66 "	July	1.82 "	Nov.	11.39 "
Apl.	5.27 "	Aug.	2.87 "	Dec.	10.89 "

During January, February and a part of March, the greater part of the watershed is snow-covered, and from October to May the precipitation over the greater part is in the form of snow.

The relation between mean annual run-off and mean annual precipitation is interesting. Assuming the watershed area to be 450 square miles, the ratio of run-off to precipitation is 1.4, which indicates that much heavier precipitation occurs over the whole watershed than at the observing station.

The records of run-off of the Stave river are based upon a long period of observation and are fairly well and firmly established. From 1905 to 1911, when the initial plant was put into operation, excellent and continuous records were kept. Since the latter date run-offs have been computed from electrical output records and spill. The mean annual run-off of the watershed for the 18-year period 1906 to 1923 inclusive, was 3,880 cubic feet per second. Studies of the mass diagrams for this period point to the conclusion that, with the regulation afforded by the raised impounding works which afford the storage of 471,000 acre-feet, the dependable flow for power purposes may be taken as 3,500 cubic feet per second. This, augmented by the supply of 700 cubic feet per second contributed by the Alouette tunnel, makes 4,200 cubic feet per second continuously available for power at Stave falls station.

The tailwater elevation of the Stave falls plant is 210. The high water elevation of the lake is 340. The intake gate sills are set at elevation 285, which permits full draft for power at a low level elevation of 306. The static heads available are:—

Maximum head	130 ft.
Average head	115 ft.
Minimum head	96 ft.

With plant efficiency of 78 per cent, allowing for all machine and penstock losses, the 4,200 cubic feet per second is capable of generating 32,000 kw. continuously, and the annual energy output is estimated at 280,000,000 kw.hrs. When the fifth unit is put in operation the installed capacity of the plant will be 65,625 kv.a. At 0.9 power factor the plant will have a peak load capacity of 59,000 kw. Owing to the limit of turbine capacity, however, it is believed that a peak capacity greater than 54,000 kw. cannot be depended upon under conditions of average head. The plant can therefore operate on an average annual load factor of 59.1 per cent. The system load factor approximates 50 per cent.

Intake Dam

The intake dam which closes the westerly channel of the river lies about 200 feet upstream from the power house and in it are set the intake gates, screens and other control structures for the proper supplying of four of the main penstocks and the two exciter penstocks. The original dam, constructed by the Western Power Company in 1911, was a full gravity section concrete structure about 55 feet maximum height, 160 feet long, and was designed to accommodate high lake level of 318 feet with a free board of 7 feet.

Provision was made in its design and construction details for raising its height at some later time. Four radial Tainter gates 19 feet wide by 20 feet high controlled the flow of the penstocks. Timber stop logs were set in the bays upstream from the gates as a means of emergency control. The raising of the intake dam entailed the placing of about 8,800 cubic yards of concrete.

In raising and reconstructing the dam to elevation 345 the Tainter gates were removed and the large wells required for their proper setting and operation were filled with concrete to give the necessary weight to the new structure. Four structural steel gates of the fixed roller type, 20 feet wide by 21 feet high clear opening, were installed in their places.

The four hoisting winches operating the gates are set upon the deck of steel structure extending over the entire length of the four gate openings. The winches are operated through separate clutches by a cross shaft driven by a 15-h.p., 125-volt, direct current motor set about mid-length of the shaft.

Emergency control of the gate openings is provided by one set of five new steel stop logs, replacing the former timber ones, and which may be dropped into checks upstream from each of the roller gates. Each stop log is formed of two I-beams connected with channels and plates rivetted on and all filled with concrete to give sufficient weight to permit placing. The stop logs are placed and removed by a travelling hoist moving along the deck on a 9-foot gauge track extending the length of the gate openings. The arrangement permits the closing of any of the openings safely and rapidly with the one set of logs provided. The engaging and lifting of the logs is accomplished by means of a steel master log with catches at either end. Figures Nos. 10 and 11 show plan and sections of the intake dam.

West Wing Dam

At the west end of the intake dam the bedrock dips sharply westward and plunges beneath the overlying strata of glacial clays, gravels and boulders. Explorations indicated that a foundation for cut-off walls on bedrock could not be reached. In order to cut off the danger of seepage in this zone a heavy retaining wall about 280 feet in length connecting with the west end of the intake dam and extending upstream some 150 feet, and then curving west into the rising shore, was constructed. The wall has its base at elevation 295, is about 50 feet in height and is founded on bedrock for about 160 feet from the intake dam and upon clay and hard pan for the remainder of its length. It contains about 3,900 cubic yards of concrete. The space back of the wall was filled with earth, the lower portions of which were hydraulic filling, and the upper portion placed with cars, but the toe of the dump was constantly kept under water, and thus a good water settling of the whole fill was obtained. About 20,000 cubic yards of filling were placed behind the wall.

Main Dam

The new main dam was formerly the sluice dam of the first builders, and as such was designed to discharge the entire flood of the river. With the raising of lake level the Blind Slough became available for this purpose, and the sluice dam was consequently filled in and raised to the proportions of a solid gravity section concrete structure with crest level at elevation 345. The old sluiceways, five in number, were 22 feet in width and were separated by concrete piers 8 feet thick. The sluiceways were closed with timber stop logs.

In the new structure a roadway 16 feet wide is provided on the crest; this road is connected with the west wing dam by a steel truss span 135 feet long bridging the intake bay in front of the penstock gates.

The intake of the penstock for the fifth unit is set in the main dam in the second bay from the east abutment of the intake dam. A fixed roller gate with hoisting winch similar to the intake gates for the other penstocks is provided for control. A vertical screen in sections is set in the old stop log checks for protecting the gate and the penstock entrance.

One of the most ingenious features of the main dam is the shingle bolt chute for the passage of bolts, which are produced in large quantities on the lake, through the dam and into the tailrace below the power house at all stages of lake water level. This feature has proved most efficient in its operation. With a water supply of 25 cubic feet per second, 10,000 bolts have been put through the chute, flume and tunnel and discharged into the tailrace in eight hours' time.

Approximately 9,500 cubic yards of concrete were placed in raising and reconstructing the main dam.

Blind Slough Dam

Before the improvement, this channel was closed with a small rock-filled timber crib structure with ten sluices, 6 by 14 feet, which served as an auxiliary spillway. With the raising of the reservoir level the former dam was discarded and replaced by a concrete dam 640 feet long consisting of a series of heavy piers with fourteen spillway bays between them and surmounted with a heavy deck slab carrying the roadway. Ten of the bays are closed with stop logs, the openings being 20 by 28 feet with sills at elevation 320. Four of the bays at the west of the stop log section are closed with the Tainter gates removed from the intake dam. These gate openings are 19 feet 6 inches high by 19 feet ½ inch wide with sills at elevation 294, some 16 feet below the sills of the stop log bays.

With the water level at 340 the combined discharging capacity of the fourteen spillway openings is 96,000 cubic feet per second. The largest recorded flood of the river occurred in 1921, when it was estimated that 60,000 cubic

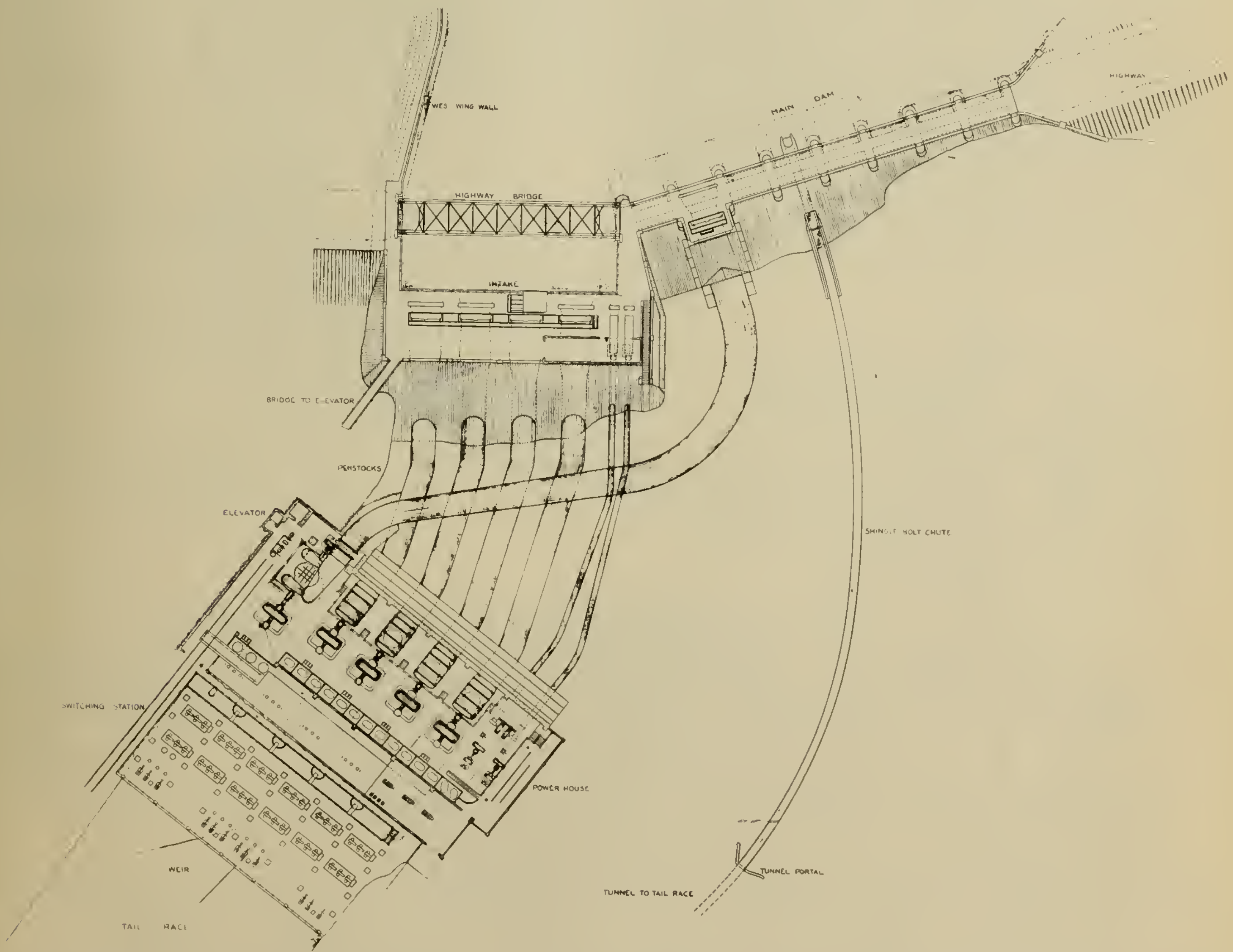


Figure No. 10.—Stave Falls Power Development—General Plan of Intake Dam, Main Dam, Penstocks and Generating Station.

feet per second were discharged by the old sluice dam and the Blind Slough auxiliary spillway dam.

The operating winches for the Tainter gates and a motor-generator set for supplying current for all purposes are set in a gate house erected upon the deck of the dam. Each winch is operated by an 8-h.p., 125-volt, direct current motor.

Upstream from each of the gates, slots are provided for the travelling emergency gate which may be placed in any of the openings to relieve the gate for repair or adjustment. This emergency gate is of the fixed roller type quite similar in design to the penstock intake gates previously described. When not in use, the gate is lifted clear of the roadway slab and moved to the end of the dam for convenient storage.

The stop logs are of timber, two pieces being bolted together with a steel stiffening plate between. The stop log machine formerly used at the sluice dam is employed for lifting and placing them. Figures Nos. 12 and 13 show the general construction and details of the Blind Slough dam. The dam contains 20,000 cubic yards of concrete.

Penstocks

The four penstocks for the original units are 14 feet 6 inches inside diameter and 190 feet in average length. The upper ends, which are embedded in the concrete of the intake dam, are belled out to a diameter of 19 feet. The plates at the upper end are ½-inch thick, and at the lower end ¾-inch thick. Roundabout seams are double riveted and longitudinal seams triple riveted; every alternate roundabout seam is stiffened with a heavy angle ring riveted on. The penstocks are supported up to their centre lines in concrete for the greater part of their lengths. A heavy continuous concrete anchor block encases all of them at the power house wall. There are two separate 46-inch steel penstocks provided for the exciter turbines.

The penstock for the new fifth unit has its intake in the main dam and hence must cross the other four main penstocks and the two exciter penstocks to reach the location of the unit at the westerly end of the power house.

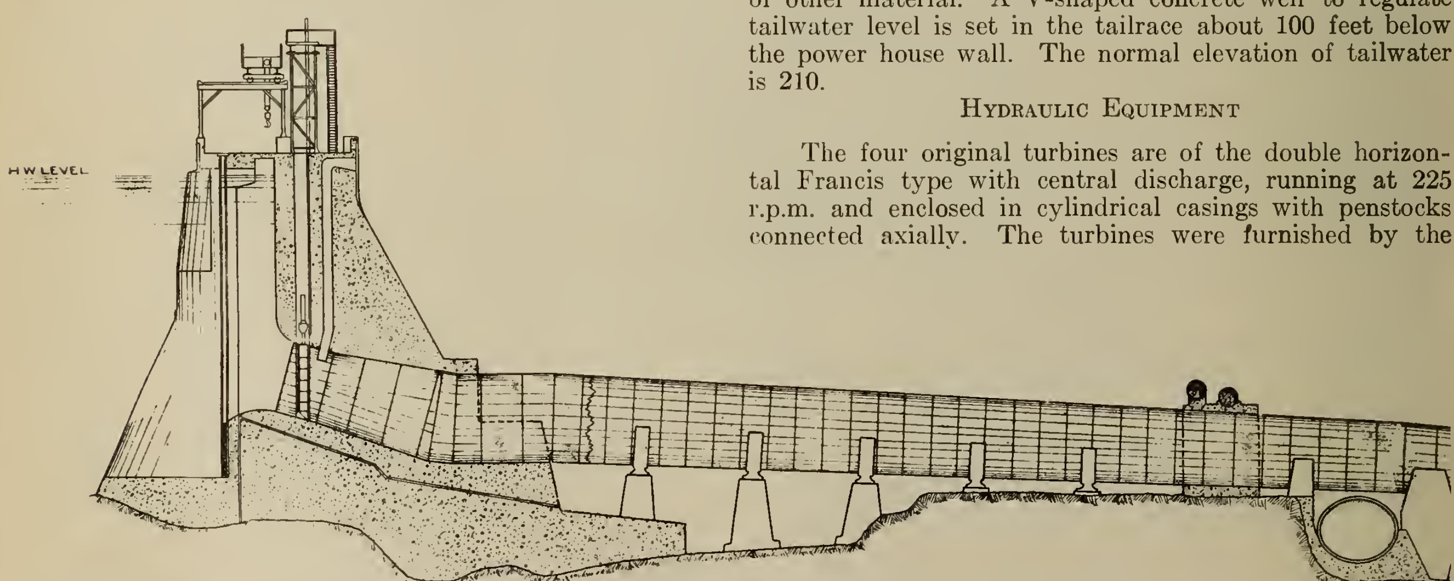


Figure No. 11.—Stave Falls Power Development—Cross-sections of Intake Dam, Main Dam, Penstocks, Generating Station.

It is 20 feet in diameter at the intake and tapers uniformly to 13 feet diameter at the butterfly valve at the power house wall.

The total length of the penstock is 324 feet. It is supported on heavy concrete piers between the existing penstocks. The profile and plan of the penstock are shown in figures Nos. 10 and 11.

Power House

The power house building is of reinforced concrete 100 feet wide, and, with the addition for the fifth unit, 215 feet long. It is set in the bed of the westerly channel some 200 feet downstream from the intake dam. The foundations rest on bedrock. Some 58,000 cubic yards of rock excavation was required in preparing foundations for the building and the machinery.

The switchboard bay extends along the east end of the building with its floor elevated some 21 feet above the generator floor. The plan and section of the building are shown in figures Nos. 10 and 11.

Switching Station

Immediately in front of the station building, on the downstream side, is located the new 60-kv. outdoor switching station. The substructure consists of a reinforced concrete slab 160 feet long by 68 feet wide supported on twelve concrete piers set in the tailrace. The superstructure of latticed steel towers and girders is 153 feet long and 50 feet wide, the maximum height being 62 feet.

Tailrace

The tailrace, 70 feet wide, is excavated in the old channel for a distance of 1,500 feet to its junction with the main river. Its construction entailed the excavation of some 22,000 cubic yards of rock and 75,000 cubic yards of other material. A V-shaped concrete weir to regulate tailwater level is set in the tailrace about 100 feet below the power house wall. The normal elevation of tailwater is 210.

Hydraulic Equipment

The four original turbines are of the double horizontal Francis type with central discharge, running at 225 r.p.m. and enclosed in cylindrical casings with penstocks connected axially. The turbines were furnished by the Escher Wyss Company of Switzerland. The casings are 18 feet in diameter, of ¾-inch steel plate with heavy forged steel flanges. The end plate is of cast steel designed to take the full hydraulic thrust. The runners are 63 inches in diameter, built of steel plates cast into their steel hubs. The bearings are water-cooled, the larger one being 15¾ inches in diameter. Draft tubes are moulded into the concrete in carefully expanding section, beginning with a circular form 8 feet in diameter and ending with a rectangular form 9 feet 5 inches by 21 feet 9 inches. The turbines are rated to develop 13,000 b.h.p. under average head of 110 feet.

The governors are of Escher Wyss hydraulic type operating under oil pressure of 300 pounds per square inch, the oil being supplied from a central pumping station equipped with two high-pressure pumps driven by impulse wheels through pipe connections from the exciter penstocks. Each pump is capable of supplying all four governor sets.

The two 250-kw. exciters are separately driven by 500-h.p. single-runner Francis type turbines, each fed by a 46-inch steel penstock.

Electrical Equipment

The four original generators were supplied by the Canadian General Electric Company. They are 3-phase, 60-cycle, 4,400-volt, 225 r.p.m. alternators rated at 8,825 kv.a. at 85 per cent power factor.

The two exciters are 250 kw. rated capacity, 125-volt, 500 r.p.m., direct-current, direct-connected to their driving turbines.

One bank of three single-phase, 4,400-kv.a., 4,000/60,000-volt, oil-insulated, water-cooled transformers is provided for each generating unit.

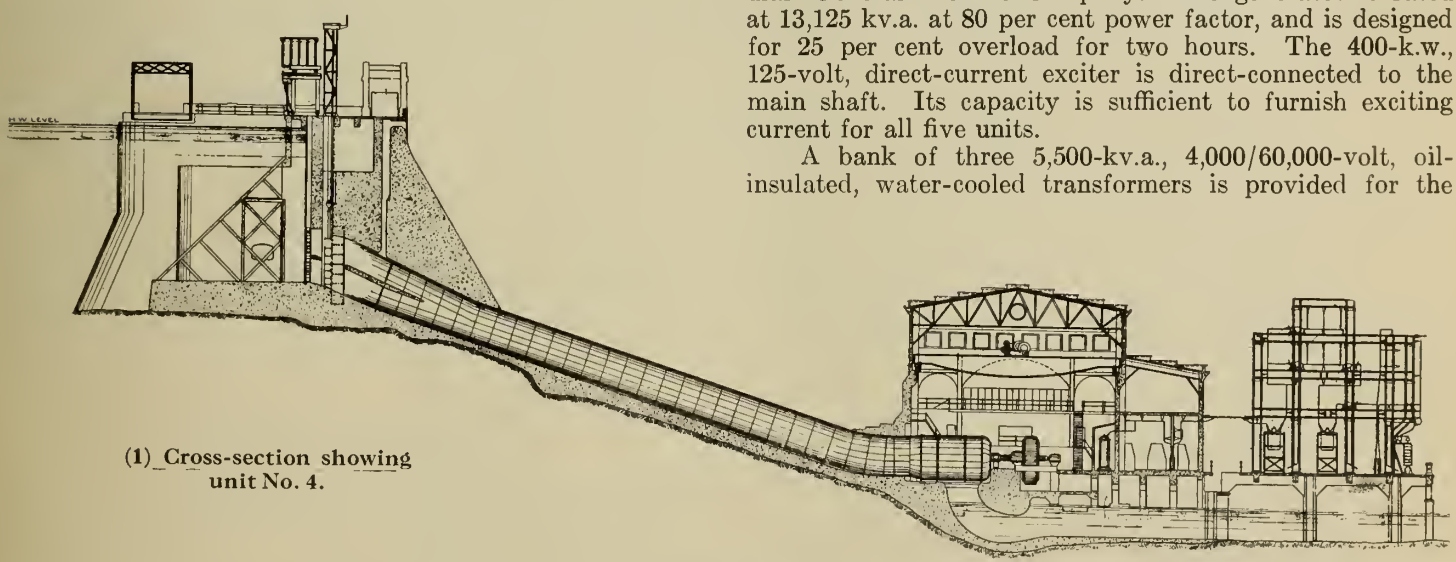
With the added water supply from the Alouette development, the continuous water energy capacity at Stave Falls could not be used with the four machines, and a fifth unit was accordingly planned, in addition to which certain changes in the four original units were undertaken. One of the four original machines was given a test run, which demonstrated that its turbines are capable, at mean head, of developing 10,800 k.w. of generated energy. Upon the undertaking of the Canadian General Electric Company that the mechanical strength of the old units would safely withstand the higher load, a contract was let to that company for rewinding and rebuilding the four original units to bring their capacity up to that of the new fifth unit, i.e., 13,125 kv.a.

The rewinding of the last of the four machines was completed in September 1925, since which time they have operated under full load satisfactorily. While no formal tests have been made, observed temperature rises indicate that their performance is in accordance with the guarantee of the manufacturer.

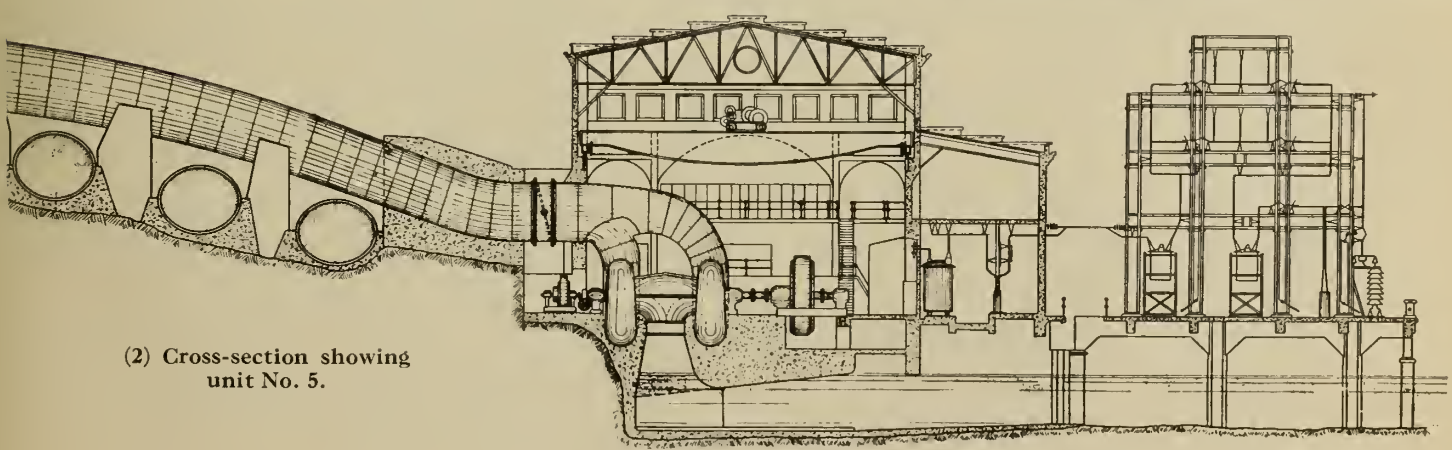
The fifth unit turbine and governor were supplied by the Canadian Allis Chalmers Company. The turbine is of the double-runner, spiral-casing, single-discharge, horizontal type, 225 r.p.m.; normal rating 15,000 b.h.p. at mean operating head.

The generator, exciter, transformers, switches and other electrical equipment were furnished by the Canadian General Electric Company. The generator is rated at 13,125 kv.a. at 80 per cent power factor, and is designed for 25 per cent overload for two hours. The 400-k.w., 125-volt, direct-current exciter is direct-connected to the main shaft. Its capacity is sufficient to furnish exciting current for all five units.

A bank of three 5,500-kv.a., 4,000/60,000-volt, oil-insulated, water-cooled transformers is provided for the



(1) Cross-section showing unit No. 4.



(2) Cross-section showing unit No. 5.

unit. The transformers are designed to operate in parallel with the existing transformers, either singly or in banks. One spare transformer is provided.

The switching equipment layout conforms in the main with standard practice, and embodies no unusual features. Figure No. 14 is a one-line wiring diagram of main circuits; the apparatus within the dotted enclosure is housed in the station building, while that outside is installed in the outdoor station.

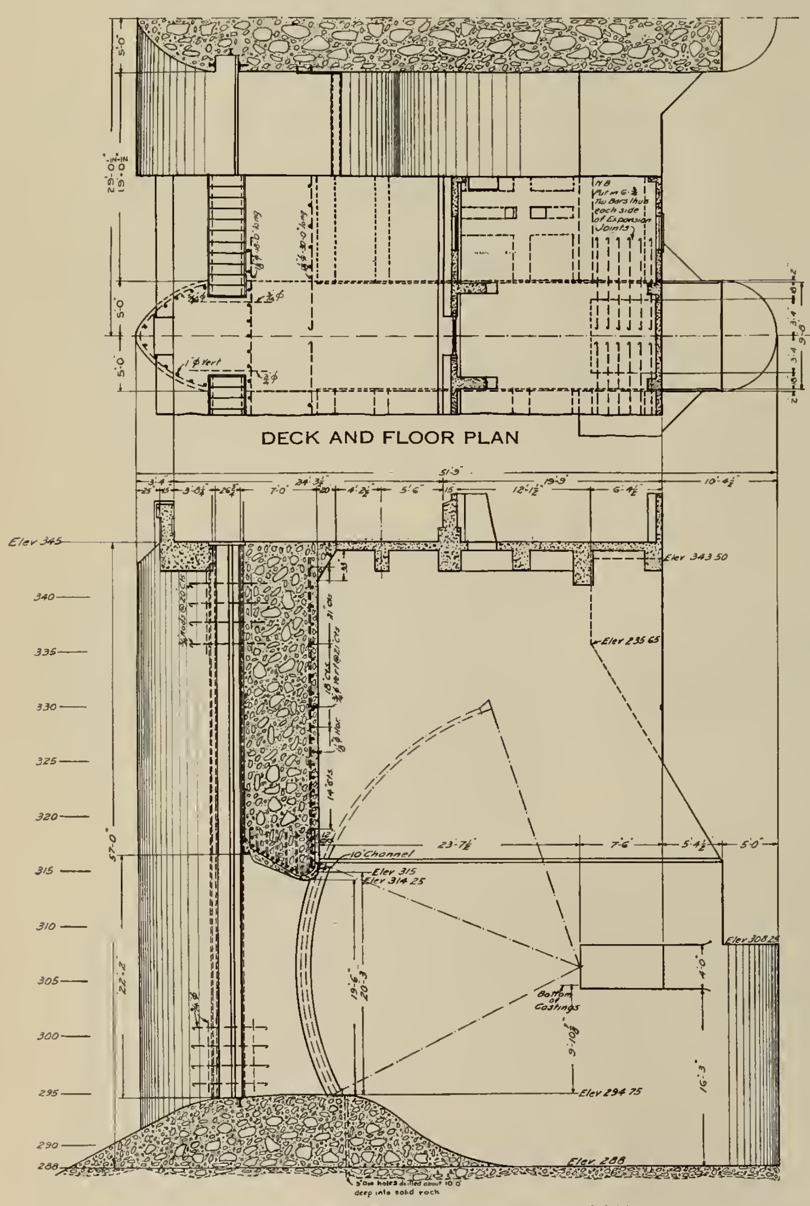
Each generator with its step-up transformer bank is considered as a unit,—the five units being tied together on the high tension buses. Between each generator and its transformers is an oil circuit breaker, (H-206), 3,000 amperes, 7,500 volts, which serves for synchronizing and for isolating the generator in case of transformer trouble. Between each step-up transformer bank and the high tension buses is an oil circuit breaker, (F.H.K. 0.136), 600 amperes, 73,000 volts, and two sets of bus selector disconnecting switches, (Pac. Elec.), 600 amperes, 73,000 volts. The disconnecting switches are of the gang-operated type connected by rods to operating levers at floor level.

Generators are star-connected with the neutral leads brought out to provide for installation of current transformers for differential relay protection, after which they are solidly grounded. The generators are protected against excessive overspeed by means of an overspeed device on the end of the shaft and by an overfrequency relay. The step-up transformers are protected by differential relays. The generator units are further protected by overload relays.

In addition to the equipment for controlling the generating units just described, provision is made for handling the output of the Alouette station. As described elsewhere in this paper, it is proposed to make this plant automatic, and it will be treated at Stave Falls as a generating unit and tied in accordingly on the high tension buses.

Two high tension, 60-kv. buses are installed to provide for the required flexibility of operation.

Feeding off the high tension buses are three transmission circuits. Two of these, the *North* and *South*, carry the greater portion of the output of the Stave Falls and Alouette stations. They are equipped with balanced differential and induction-type overload relays. The third circuit, the "Bellingham," at present feeds into the Puget Sound Power and Light Company's system at Bellingham, Washington, but provision is made for its ultimate use as one of two tie lines to the Ruskin station, when that portion of the Alouette-Stave development is undertaken. The line is equipped with induction-type overload relays. On account of the importance of the North and South lines and the desirability of



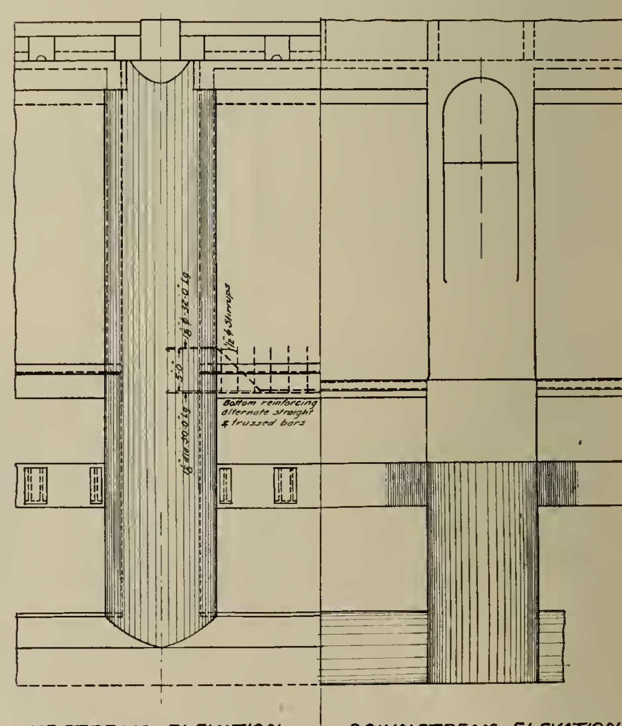


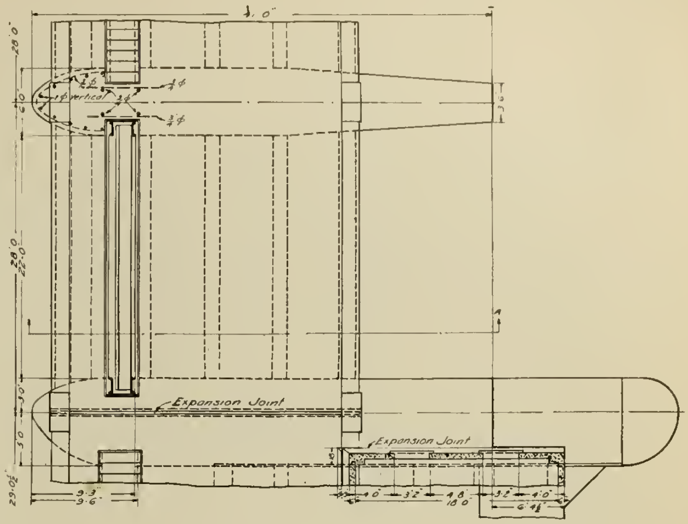
Figure No. 12.—Stave Falls Power Development—Typical Plan and Elevations of Tainter Gate Section of Blind Slough Dam.

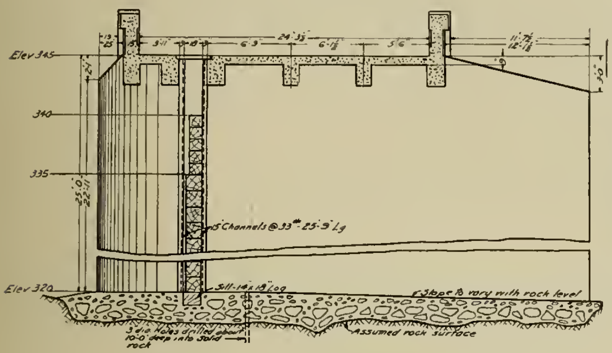
maintaining the maximum continuity of service, two oil circuit breakers are installed on each of these circuits, one on each high tension bus. The Bellingham line has one circuit breaker, bus selection being made with disconnecting switches. Transmission line oil circuit breakers and disconnecting switches are of the same type and capacity as those mentioned previously. Transmission and tie lines are equipped with choke coils and lightning arresters of the oxide film type.

Feeding off the high tension buses, a circuit leads back into the station building to a bank of 60/12 kv. transformers for supplying 12 kv. current for local use.

The switchboard gallery affords an unobstructed view of turbines, generators and low tension oil circuit breakers.

Facing the front of the gallery is the main switchboard which contains the control switches and instruments. In addition to the usual indicating and recording instruments, there are provided five 8-point graphic temperature recorders. These are arranged to indicate and record generator stator winding and step-up transformer oil temperatures. Behind the main switchboard is an auxiliary upon which are mounted all relays and the station service control equipment. Directly under the switchboard gallery is the direct current room, where exciter current is centralized and distributed. In this room are also located the generator field rheostats.





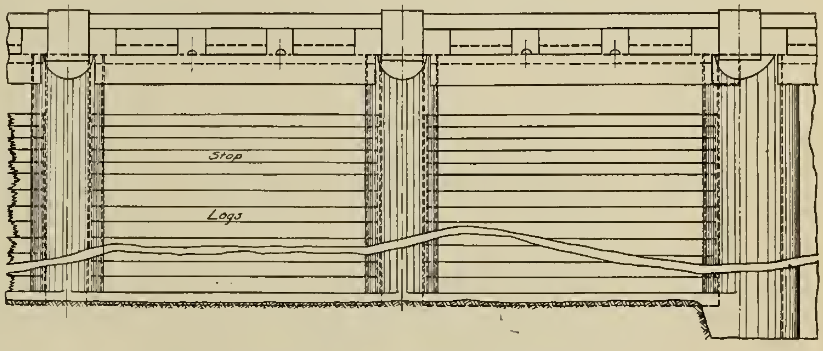


Figure No. 13.—Stave Falls Power Development Stop Log Section, Typical Plan and Elevations of Blind Slough Dam.

The Ruskin Development

The site of the Ruskin development, the last of the group under discussion, lies at a point on the Stave river, about 3½ miles downstream from Stave Falls, and near the junction of the Stave river with the Fraser river.

After meandering through the terraced valley below Stave falls, the river has cut its way deeply through a rock barrier that once blocked its course and from which it debouches into the flood plain of the Fraser at little above tidal level. The lower section of the gorge thus formed affords the site for the development.

While the water rights for the project have been held and maintained by the company for many years, no particular or detailed study of the structures required for its development nor their cost had been made until recently. The site has now been thoroughly surveyed, explored by test borings and preliminary plans for a scheme of development have been made. These will furnish the basis for this discussion. The site will not be developed, under any circumstances, until the power needs of the company shall warrant it.

Strange as it may seem, the river, in cutting its way through a morainal barrier which crossed the site, ignored the softer zones of glacial outwash that flanked, and probably covered, a spur of bedrock and started to form its new channel by cutting in a quartering direction into the solid rock barrier. Once started it continued its erosion and the formation of the Ruskin gorge, some 160 feet deep, with abrupt walls rising on either side, has resulted from its action. Borings have developed the fact that the exposed bedrock at the rims of the gorge are the highest points and that the bedrock drops away on either side from these exposures. The drawing in figure No. 15 shows plainly the relationship of surface topography to bedrock topography as closely as the borings reveal it.

The plan of development has been conceived to meet the conditions imposed by the subsurface topography of the bedrock, which, in a general way, have controlled the major elements of the design.

The site has no contributing watershed as such, its water being drawn from the tailwater of the Stave Falls plant, 3½ miles upstream. Its reservoir will function only as a forebay to regulate these waters; only daily regulation will be possible. The average water supply is therefore taken as 4,200 cubic feet per second.

The head available will be limited to that created by the dam. No falls or rapids of any consequence exist at the site. The high water level of the Ruskin reservoir will nominally conform to the tail water level of the Stave Falls plant, which is 210.

The elevation of the tailwater is variable owing to the fluctuations of flood level of the Fraser, which vary from possible extreme elevation of 100 during the summer

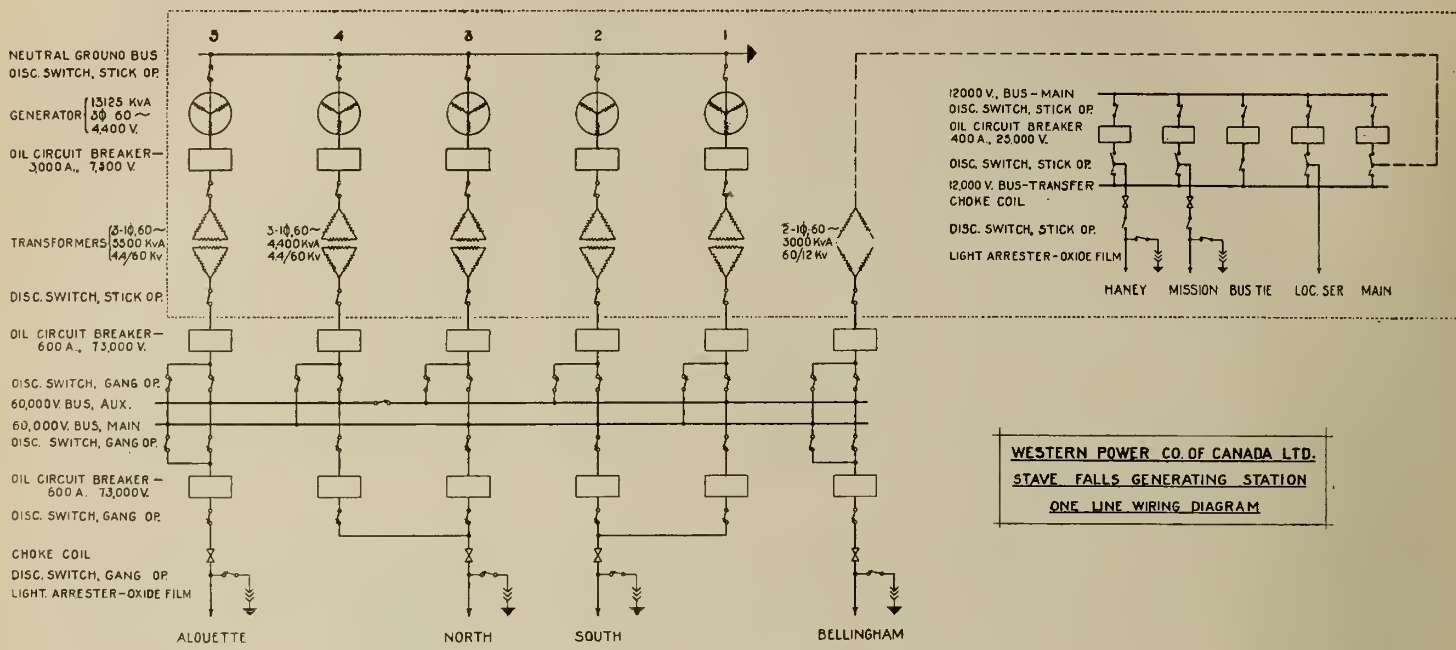


Figure No. 14.—Stave Falls Power Development Generating Station—One-line Wiring Diagram of Main Circuits.

freshet season to 76 at the low water winter flow. Daily variations of level will also occur at certain stages owing to tidal influence. A study of all conditions leads to the conclusion that 83 may be taken as the average elevation of tailwater.

The following heads were taken as a basis of the investigation:—

	Static head.
Average	126 feet
Normal low	119 "
Normal high	131 "
Extreme high	139 "
Extreme low	100 "

The forebay storage lake formed above the dam will be about 700 acres in extent. The Stave Falls plant under full load will discharge into the forebay at the rate of about 7,100 cubic feet per second. The four Ruskin units will draw under full load at the rate of about 9,100 cubic feet per second. The excess of draft over input will result in drawing down the forebay level at peak load periods at a maximum rate of about 3 inches per hour. Under normal operation of 2-hour peak load period, the variation in forebay level will be slight; a 12-hour peak operation would not lower the water more than 3 feet.

If the Stave Falls plant were fully shut down the Ruskin plant could operate at full capacity for 9 hours without drawing the forebay level more than 10 feet.

With assumed over-all plant efficiency of 84 per cent, the 4,200 cubic feet per second available at Ruskin is capable of generating 37,000 kw. continuously and the annual energy output is estimated at 328,000,000 kw. hrs.

The proposed development as preliminary determined is a simple one. A dam closes the gorge, raising the water level of the river from elevation 80 to 215; a headrace on the west bank admits and conveys the water to the penstock headgates, from which the penstocks conduct it to the station on the east bank of the river below the gorge.

The perspective study shown in figure No. 16 gives the essential features of the development.

Main Dam

The main dam as planned is a concrete structure, gravity section, crest overflow type with ten bays of regulating gates set between piers supporting a deck 31 feet wide which carries the gate-operating gear and a roadway. The dimensions of the dam are:—

Length of crest	325 feet
Maximum height	183 "
Elevation of deck	220 "
Elevation of overflow crest	190 "

The foundations will rest on the granite bedrock of the gorge. Some 35,000 cubic yards of boulders, loose rock and top bedrock will be excavated to prepare the foundation for the reception of concrete. The excavation will have a maximum depth of 35 feet.

The diversion of the river to permit the excavation of the foundations will be costly. The cofferdams, one at the upstream face and one at the downstream toe to hold out the back water, will be required. A diversion tunnel or an extensive timber flume will be necessary to carry the 7,000 cubic feet per second of tailwater from the Stave Falls plant. Probably the flume method will prove the most economical, although the tunnel method is shown on the plan. The seasonal floods will not be a particular menace as the preparation of the lower parts of the foundation and the pouring of the base of the dam up to a safe level can easily be accomplished during the normal dry season extended by the controlling agency of the Stave Falls dam.

The dam proper is estimated to contain approximately 87,000 cubic yards of concrete. The aggregates will be obtained by dredging and pumping from the foreshore in front of the power house and distant about 1,500 feet from the dam.

Owing to the conformation of the bedrock the west abutment of the dam is founded at elevation 160, some 30 feet below the crest and 55 feet below extreme high water level. In order to insure a cut-off to the bedrock to prevent leakage and erosion in the sandy formation traversed, a curtain of steel sheet piling 600 feet long and averaging 50 feet in depth will be necessary. As an alternative, a plan of blanketing the hillside with hydraulic fill has been considered. The sheet piling method seems the more practicable, provided the formation proves favourable for driving.

Ten crest gates with 25 feet clear opening and 21 feet in depth are planned to control the flood overflow. The gates will be of the Stoney Roller type with head frames and operating gear set upon the main deck.

A shingle bolt flume for the passing of bolts will extend from the west abutment to the river opposite the tailrace. As the variation in the reservoir water level will be comparatively slight, the head works for the flume are much simpler than at Stave Falls plant. The flume as planned is entirely of concrete.

Headrace

The headrace is planned as an excavated basin extending from the reservoir to the penstock headworks. The curved intake, 300 feet long with sill at elevation of 182.5, will rest entirely on bedrock, and will consist of two abutments and eleven concrete piers supporting the primary screens. No gates will be provided at the intake, but the piers will be designed for the setting of emergency stop logs to permit shutting the water out of the basin at lower stages of the reservoir.

An extensive excavation will be required to form the headrace. About 160,000 cubic yards will be removed, of which 100,000 cubic yards are estimated as earth and 60,000 cubic yards as rock. Much of the earth may be removed by sluicing. About 80,000 cubic yards will be deposited hydraulically on the slope above the intake to reinforce the bank against possible seepage through the ridge west of the headrace, which is composed of gravel

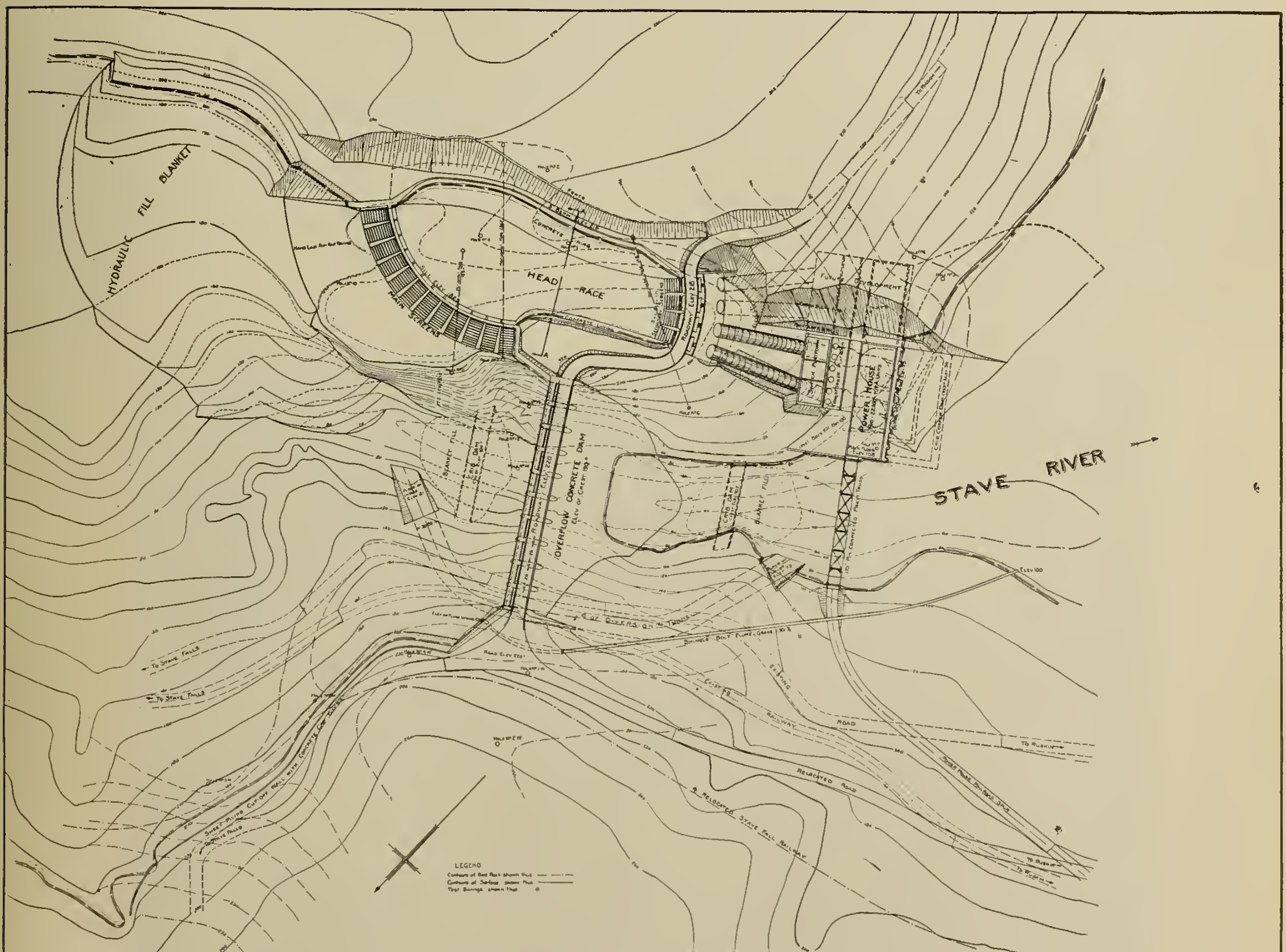


Figure No. 15.—Ruskin Power Development—General Plan of Proposed Plant.

and boulders carrying little clay. The remainder of the excavated material will be wasted in the tidal flat south of the power station, where an area for use as station grounds and operators' quarters will be built up.

The entrance apron to the intake will be paved with rock for a width of 100 feet. Approximately 15,000 cubic yards of concrete will be required in the construction of the headrace, including the penstock headworks.

The headrace will be lined with concrete throughout. Bottom linings will be 12 inches thick, and side linings 3 feet to 18 inches thick with nominal reinforcement. Where bottom lining is placed on earth or gravel, the foundation will be thoroughly settled with water before concreting.

Primary screens, with 4-inch clear openings between bars, will be set in the panels between piers at the headrace intake. Secondary screens with 1½-inch clear opening are provided in front of the penstock intakes.

Stop-log slots are provided for closing the penstock intake openings in front of the headgates. One set of steel stop-logs with operating machine will be provided for emergency use in clearing the gates and penstocks for inspection and repair.

Four penstock headgates of the Stoney roller type or the caterpillar self-closing type will be installed. The gates as planned are 19 by 19 feet clear opening and the maximum head to sills will be 44 feet.

Penstocks

The four penstocks for the ultimate plant as planned will be riveted steel pipes with an average length of 225 feet, and inside diameter of 19 feet and will be 9/16 to 13/16 inch plate, butt jointed and provided with stiffening rings of angle iron as required. The hillside will be excavated to an extent which will permit the placing of the pipes on bedrock. Some 9,000 cubic yards of rock and 15,000 cubic yards of earth excavation will be necessary for this purpose. The pipes will be supported on concrete piers and anchor blocks.

Balanced valves of some type will be provided for control at the lower end of the penstocks.

Power House

Only a rough preliminary design of the station building, sufficient for close estimating purposes, has been prepared. It is planned as a combination steel frame and reinforced concrete building of sufficient size to house the four proposed units. It will consist of a generator room 48 by 265 feet, with floor level at elevation 103, fronting the tailrace. Immediately back of the generator room, a two-storey bay 18 feet wide extends the full length of the building. The lower storey is designed for low tension use and the upper for switchboard purposes. Back again of this bay the transformer bay, 25 feet wide, extends the length of the building. The outdoor type transformers are placed on the upper deck of the bay, the space beneath being intended for storage. The rear bay, 34 by 265 feet, will be used for high tension switching, buses and supporting steel structures. The transformer and switching bays are not enclosed.

Owing to the bedrock topography and the relation of tailwater level, an extensive and costly excavation job is entailed in preparing for the power house foundations. Since the lowest foundations extend some 50 feet below the tailwater level, a coffer dam barrier surrounding the entire work will be necessary. This is planned as a timber crib to be filled and sunk in place fronted with a cut-off of steel sheet piling extending to bedrock. It is estimated that some 8,500 cubic yards of earth and gravel

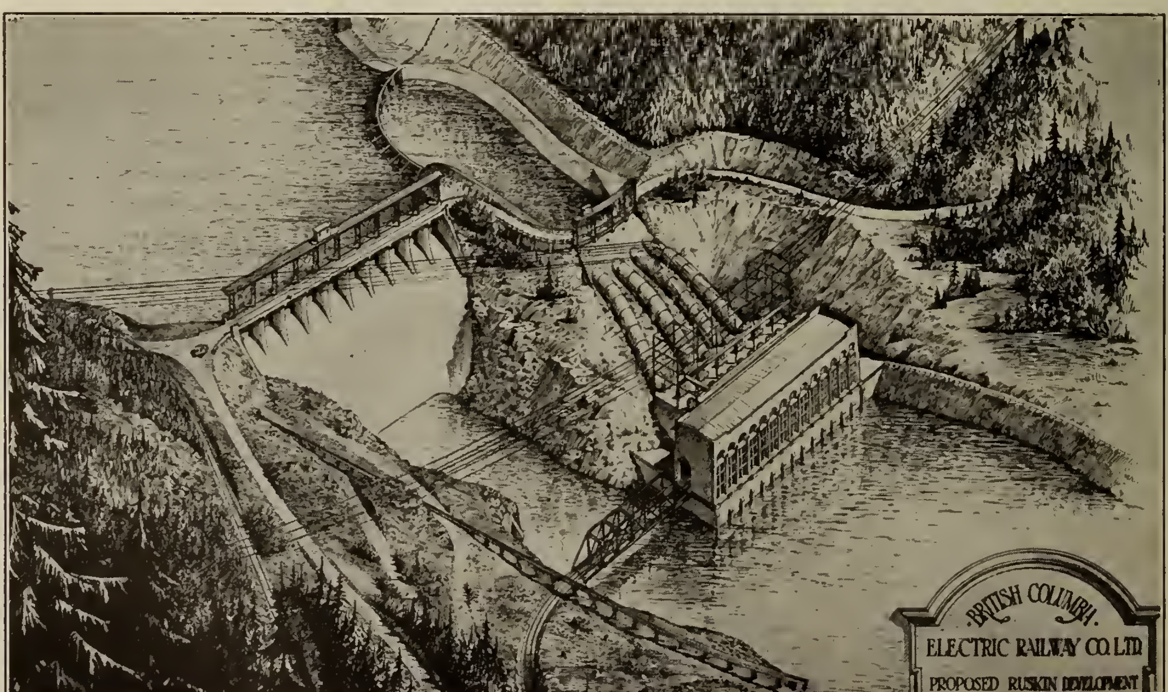


Figure No. 16.—Perspective Study of Proposed Ruskin Development.

and 11,500 cubic yards of rock will be removed to provide a setting for the foundations. In addition, some 5,000 to 10,000 cubic yards of material outside the coffer dam will be removed by dredging to provide space for the tailwater discharge.

Estimates call for the placing of some 11,000 cubic yards of concrete in the building and its foundations.

Hydraulic and Electrical Equipment

The plant as conceived will consist of four 30,000-b.h.p., reaction turbine units, direct-connected to four 22,500-kv.a. generators, all with vertical settings. Two units will be installed in the initial undertaking; the installation of the remaining two to be deferred until required. This installation will just about balance the whole system for load factor requirements. A review of these conditions may be interesting:—

Comparison of Plant Load Factors

(Ratios of Continuous to Installed Capacities at 0.9 Power Factor)

Plant.	Continuous kw.	Installed kv.a.	Installed kw.	Load factor per cent.
Buntzen Nos. 1 and 2...	16,650	47,700	43,030	38.7
Stave Falls	31,950	65,620	54,000	59.1
Alouette	6,550	10,000	9,000	72.9
Ruskin (proposed)	37,400	90,000	81,000	46.2
System total and mean.	92,550	213,320	187,030	49.5

At normal low head, the four 30,000-h.p. wheels will require nearly 10,000 cubic feet per second to drive the generators.

A spur track about a quarter of a mile long connects the site with the main line of the Stave Falls Railway, thus affording rail transportation to storage and construction yards. The river south of the power house is spanned with a permanent steel bridge which brings the tracks inside the station building and under the crane.

Acknowledgment

The data for the paper have been drawn from many sources. In this respect, the writer wishes to acknowledge as particularly valuable two most excellent technical papers previously prepared and presented.

The first, by the late R. F. Hayward, M.E.I.C., having for its subject "The Stave Falls Power Development of the Western Canada Power Company, Limited," was read by its author at the monthly meeting of the Canadian Society of Civil Engineers at Montreal on October 7th, 1915, and is printed in Vol. XXIX, Part II of the Transactions of the Society.

The second paper, by J. I. Newell, electrical superintendent, and A. F. Tredcroft, A.M.E.I.C., resident engineer for the British Columbia Electric Railway Company, Limited, has for its subject "Stave Falls Power Development of the British Columbia Electric Railway Company, Limited," and was read by Mr. Newell before the Vancouver section of the American Institute of Electrical Engineers on August 30th, 1924.

The general plans involved in the raising of the dams and the installing of the fifth unit at Stave Falls were prepared by R. S. Kelsch, M.E.I.C., consulting engineer. Details of electrical features, specifications and working drawings were prepared, and the work carried out by the electrical department of the company under the direction of Mr. Newell, assisted by R. M. Skinner, superintendent of construction, and Mr. Tredcroft.

The Alouette project was designed and is being installed by the construction department of the company, under the direction of the writer, assisted by C. E. Blee, assistant engineer, S. P. Wing, designing engineer, James Gilbert, construction engineer, and the other members of the staff whose valued co-operation is acknowledged.

The valuable assistance of Mr. Blee and C. W. Colvin, assistant electrical engineer, in preparing the paper is especially acknowledged.

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VOLUME X JANUARY 1927 No. 1

Amendments to By-Laws

The following circular letter regarding the proposed amendments to the By-laws has been mailed to all corporate members of The Institute, in accordance with By-law Section No. 76:—

To Corporate Members,
The Engineering Institute of Canada.

AMENDMENTS TO BY-LAWS

In accordance with Section 76 of the By-laws, Council has approved the following proposals for amendments to the By-laws of The Institute; these, having been drawn up by the Committee on Legislation and By-laws, are here given for the information of members, and will be presented for discussion at the forthcoming Annual General Meeting, after which they will be submitted by letter ballot to the Corporate Membership of The Institute.

The proposed amendments are as follows:—

Section 13, Paragraph 3, lines 2 and 3.

The words "priority of election to the office of Vice-President" to read "priority of election as a Vice-President."

Section 38, last line of Paragraph 1.

Delete all words after "vote" and substitute the following: "Council may take action in the case of a member who is in arrears by:—

(a) Directing that he shall not receive the publications of The Institute
and/or
(b) Removing his name from the register of members."

R. J. DURLEY,
Secretary.

Meeting of Council

Meeting of December 14th, 1926

A meeting of Council was held at eight p.m. on Tuesday, December 14th, Mr. Geo. R. MacLeod in the chair, and four members of Council being present.

The report of the Finance Committee with the financial statement to November 30th was approved, and nine special cases were given consideration. Two requests for reinstatement were considered and approved, and six resignations were accepted.

Life memberships were granted to Mr. R. Armour, Toronto, who has been a member since 1887, and to Baron Gustave de Coriolis, of Paris, France, on account of their advanced age.

The revised programme for the forthcoming Annual Meeting at Quebec, embodying the suggestions of the Executive Committee of the Quebec Branch, was submitted and approved.

The annual reports of the following Committees of The Institute were considered and approved:—

Publication Committee,
Papers Committee,
International Co-operation,
Code of Ethics,
Legislation and By-laws.

The membership of the Leonard Medal Committee for the year 1926 was submitted and approved as follows:—

J. C. Kemp, A.M.E.I.C., *Chairman.*
Dr. A. Stansfield, M.E.I.C.
G. D. Macdougall, M.E.I.C.
J. F. Robertson, M.E.I.C.
A. B. Ritchie, A.M.E.I.C.

The list of officers of the St. Maurice Valley Branch was submitted and unanimously approved as follows:—

Ellwood Wilson, M.E.I.C., *Chairman.*
R. Morrissette, A.M.E.I.C., *Secretary-Treasurer.*
H. Dessaulles, A.M.E.I.C. }
B. Grand Mont, A.M.E.I.C. } *Executive Committee.*
S. W. Slater, A.M.E.I.C. }

The gift of a number of old engineering books from Colonel E. B. Worthington, of Sherbrooke, Que., was announced, and the donor was thanked for his generosity.

The following elections and transfers were effected:—

Elections

Members	1
Associate Members	1
Juniors	2
Affiliates	1
Students	24

Transfers

Associate Member to Member	1
Junior to Associate Member	2
Student to Associate Member	2
Student to Junior	4

Twenty-two applications for admission and transfer were scrutinized and classified for the ballot returnable January 17th, 1927.

Four special cases were considered in connection with applications for admission.

The Council rose at eleven-thirty o'clock p.m.

See page 42 for Programme of the Annual General Professional Meeting and page 58 for Railway and Hotel Arrangements for the Meeting

The Need of a Forest Policy

The proper conservation and utilization of our forest resources is not only of vital importance to every Canadian, but has a special and personal interest for engineers of all branches of the profession. This fact is not always realized, but a little reflection will be convincing. A very large proportion of all present engineering and industrial activities in Canada is either directly or indirectly dependent on forest products and forest industries, as these require the services of engineers in so many fields of work; for example: the manufacture of logging, pulp making and paper making machinery; the provision of electrical equipment and turbines; the construction of power houses and dams; the measurement and regulation of streams; transportation and shipping; the provision of aeronautical equipment for fire protection and photography. Many other items might be added to this list. Proper and practical methods for forest conservation, for the maintenance of our supply of timber and wood, and for their economical transportation and manufacture are therefore the concern of all engineers, and members of the engineering profession should be fully informed as to the present situation.

The average man is somewhat bewildered by the mass of statistics which appear from time to time in the public press regarding the denudation of our forests and the toll which fire takes from our timber resources, and he knows little or nothing about the existing stand of timber, whether it is being cut wisely or wastefully, or the rate at which cut-over areas can recuperate under natural and artificial reforestation.

In 1923, the annual drain on the soft-wood forest resources of the Dominion from all causes was estimated at about 4,000 million cubic feet, and since that time the consumption has largely increased. It seems evident that with a total estimated stand of, say, 200,000 million cubic feet, (of which half is inaccessible at present prices), it will not be long before the industry as a whole will have to depend for its supply on areas already cut-over and on what virgin timber is left in the more inaccessible regions. In this connection, it may be noted that in Canada there are many areas of virgin forest in which a large proportion of the trees have passed the age of maximum production, so that their annual contribution to our stock of available timber is less than is generally supposed. Such areas can only be rendered fully productive through proper forest management. There is little reliable information as to the length of time required for natural reforestation, varying as it does in accordance with locality, climate, seasonal conditions, nature of soil, and so on.

The last few years have witnessed a phenomenal increase in the number of Canadian pulp and paper mills, operating and projected, and their consumption of pulp wood, particularly for newsprint, is advancing by leaps and bounds. Some idea of the call now being made on our forest resources by the pulp and paper industry can be obtained when it is remembered that the requirements of a single large modern newsprint mill may involve the clearing of about one square mile of timber per week.

Passing to the question of conservation, the appalling extent of our fire losses is well known, and the disastrous economic consequences that will result from their continuance must be so obvious to all thinking persons as to make it unnecessary to lay stress on the fire danger here. But while fire damage is the best known sign that all is not well with our forests, it is by no means the only one. Another disquieting symptom is the fact that in so many districts land has been thrown open to colonization, has been settled, the forest has been removed or burned off, and the settlers have abandoned their farms, in many cases leaving the land useless either for agriculture or timber. The expansion of agriculture is, of course, a necessary and desirable thing, and there can be no question as to the propriety of clearing the forest from land on which real farms can be made, but colonization should not involve taking land which cannot support real farms, allowing it to be stripped of its timber, and then to be abandoned.

The gravity of this situation is not altogether to be measured by the actual quantities of wood concerned, although these are large, but by such considerations as the following: in the first place, such colonization contributes in a marked degree to the fire risk, in that settlers' brush has to be burned in close proximity to the green forest, and that it is frequently burned carelessly. Secondly, the possibility of losing their limits through colonization, or by suffering heavy losses of green timber through settlers' fires, discourages limit holders from making the heavy expenditures on their forests that are entailed by the preparation of comprehensive inventories and working plans and the adoption of the most modern methods of management.

It is true that the various provincial governments make forest laws and regulations from time to time, but these are as a rule concerned rather with individual points than with general policy, and do not grapple with underlying causes. A constructive forest policy should be in force everywhere, and should be based on two things, namely, adequate fire protection and an immediate and wholesale classification of the Crown lands, leading up to the formation of permanent forest reserves, that is to say, areas devoted to wood production in perpetuity.

This is not a new or revolutionary policy, it is merely common sense applied to the regulation of the forests.

Adequate fire protection, which means such legal, educational or practical measures as are found actually to stop the fires, is an absolutely necessary preliminary condition, without which all other effort towards conservation must be wasted; and the institution of permanent forest reserves based on land classification would immediately stop the losses now caused by mistaken colonization and its attendant fires, and would make possible the introduction of improved methods of forest management such as would not only ensure the perpetuation of the forest but would increase the future yield of wood per unit of area.

It seems evident that if the fire risk were reduced to a minimum, and if security were guaranteed to limit holders in the tenure of their timber lands, improvements and reforms on the part of the limit holders would either follow automatically or would be demanded by public opinion, and that a superstructure of forest laws to deal with matters of detail could gradually be built up.

Following on the effective and universal adoption of such a policy, limit holders could be required more effectively to take such measures as reforestation of logged areas, proper disposal of slash, adoption of improved methods of logging, and the like, while wasteful and uneconomical methods of transportation and manufacture would be discouraged.

The foregoing are only a few of the factors that must be considered when discussing the future of the forest industries in Canada which deserve far more attention on the part of the general public than they now receive.

With the hope of forming a correct and instructed body of opinion regarding these matters among the members of the Engineering Institute of Canada, a series of papers on subjects connected with forest preservation and forest utilization has been arranged for the forthcoming Annual Professional Meeting of The Institute at Quebec in February next, and it is expected that the discussions on these will throw light, not only on the nature of the problems which are pressing upon us, but also on the means to be adopted for their solution.

Genuine reform in a democratic state must come from the force of public opinion, and at the present time the members of The Institute can render no greater public service than in aiding to bring about this result by familiarizing themselves with the present conditions, drawing attention to the fact that our forest resources are not boundless, but are lessening day by day, and impressing on the laymen with whom they come in contact the defects of the present methods of operation, and the necessity and practicability of better ones.

Annual General and General Professional Meeting

The Annual General Meeting will be convened at Headquarters, 176 Mansfield Street, Montreal, on Thursday, January 27th, 1927, at 8.00 p.m.; after the reading of the minutes of the last Annual General Meeting, the appointment of Scrutineers to count the Officers' Ballot, and the appointment of the Auditors for the ensuing year, the meeting will be adjourned to reconvene at the Chateau Frontenac, Quebec City, February 15th to 17th, 1927.

Meeting at Quebec City

Chateau Frontenac—February 15th, 16th and 17th, 1927

PROGRAMME

(*Subject to Revision*)

Tuesday, February 15th.

9.00 a.m. Registration.

10.00 a.m. Reception and discussion of reports from Council, Committees and Branches. Scrutineers' report and election of officers. Retiring President's address. Induction of new President.

1.00 p.m. Lunch—complimentary to visitors. Welcome to members by Chairman of the Quebec Branch, who will preside. Brief address by the Mayor of Quebec.

1.00 p.m. Lunch for ladies.

3.00 p.m. Continuation of Annual General Meeting—unfinished and new business.

9.00 p.m. Smoker or special entertainment. (Admission by ticket.)

9.00 p.m. Theatre party for ladies.

Wednesday, February 16th.

10.00 a.m. First technical session.

Room A—

Notes on the Forests of Quebec—G. C. Piché, A.M.E.I.C. Deals with questions of forest administration.

The Wood Consuming Industries of Canada—John Stadler, M.E.I.C. Has special reference to pulp and paper manufacture.

Woodlands Management and Operation—S. L. de Carteret, A.M.E.I.C.

Transportation in Pulpwood Operations—G. E. La Mothe, A.M.E.I.C. Outlines modern methods of handling wood from the forest to the mill.

Room B—

Electrical Characteristics of Quebec-Isle Maligne Transmission Line—Professor C. V. Christie, M.E.I.C. Deals with the most recent large transmission line in Eastern Canada.

Alternating Current Electrolysis—Professor J. W. Shipley. Further experimental work in this interesting field.

Building an Industrial Plant in the Saguenay District—John L. Guest. Covers the construction problems encountered in building the works of the Aluminum Company of Canada at Arvida, Que.

Protection Against Seepage at Lake Kenogami—O. O. Lefebvre, M.E.I.C. The methods adopted to cope with a difficult situation.

2.00 p.m. Visit to Quebec Bridge or St. Malo Shops.

7.30 p.m. Annual Dinner of Institute. (Admission by ticket.) President in the Chair.

7.30 p.m. Dinner for ladies.

Thursday, February 17th.

10.00 a.m. Second technical session.

Design and Construction Features of Rack Structure and Penstock Intake for Isle Maligne Station of Duke-Price Power Company, Limited, on Saguenay River, Province of Quebec, Canada—W. S. Lee, M.E.I.C. Data regarding a vital portion of this important development.

The Water Power Developments of the Alouette-Stave-Ruskin Group—E. E. Carpenter, M.E.I.C. Describes an interesting group of hydro-electric plants in British Columbia.

Developments of the Gatineau Power Company on the Gatineau River—A. H. White, M.E.I.C. Data regarding the three installations at Farmers, Chelsea and Paugan, with notes on some special features of design.

2.00 p.m. Third technical session.

Notes on the Ore Deposits of Western Quebec—Theo C. Denis. Deals with the geological relations of the new goldfields.

The Metal Mining Industry of Northern Ontario—W. R. Rogers, A.M.E.I.C.

Discussion of papers previously presented.

5 p.m. to 7 p.m. Ladies will be entertained at tea.

8.30 p.m. Supper-dance and Bridge in Ball Room. (Admission by ticket.)

OBITUARIES

Francis Clarke Gamble, M.E.I.C.

From coast to coast in Canada members of The Institute have learned with the greatest regret of the passing of Francis Clarke Gamble, M.E.I.C., one of Canada's pioneer railway builders and one who, within the profession and in all walks of life, was held in the highest esteem by all who were privileged to know him.

A staunch supporter of The Institute ever since its incorporation as the Canadian Society of Civil Engineers, Mr. Gamble took a very active part in its affairs. He joined as Member on January 20th, 1887. He was elected a member of Council in 1892 and again in 1898. In 1913 and 1914 he was vice-president and in 1915 became president.

Born in Toronto on October 23rd, 1848, he attended Upper Canada College, where he received his primary education, later continuing his studies under private tuition and subsequently at the Rensselaer Polytechnic Institute of Troy, N.Y.

FRANCIS CLARKE GAMBLE, M.E.I.C.

Choosing the engineering profession as his life work as far back as 1869, he entered the employ of the Intercolonial Railway, serving in various junior capacities until 1870. Subsequently he became assistant engineer with the Great Western Railway; resident engineer for contracts of the Prince Edward Island Railway; assistant engineer on the Intercolonial Railway during the years 1876-1877 and for the Q. M. and O. R. the following year.

In 1879, Mr. Gamble was engaged in private practice. The following year he was first assistant engineer on contract No. 42, of the Canadian Pacific Railway, and the next year in the same capacity in British Columbia. From 1881 until 1887, he was assistant engineer with the Department of Public Works, British Columbia, and for the following ten years was government agent and resident engineer for that department. In the year 1897 he was again engaged in private practice and in 1898 was appointed public works engineer for the provincial government of British Columbia, becoming chief engineer of the Department of Railways for the province in 1910.

He was recognized as a high authority on the various professional works to which he devoted his time, and after retiring from active practice in 1918 he continued to take a great interest in the affairs of The Institute and of the profession in general.

Noel Edgell Brooks, M.E.I.C.

Noel Edgell Brooks, M.E.I.C., of Sherbrooke, Que., one of The Institute's earliest members, passed away following a sudden attack of heart trouble on May 12th, 1926.

The late Mr. Brooks was born at Sherbrooke on December 25th, 1866, and at the age of eighteen commenced his first engineering work as assistant on surveys and preliminary work with the Pecos Valley Irrigation Company in New Mexico. He was engaged on this work for two years, and returning to Canada he spent the next two years with the Canadian Pacific Railway Company as rodman, first on the Smith Falls branch and later on the Atlantic and Northwest branch. In connection with the latter work, he was appointed resident engineer on construction in 1888. This was his first important engineering work, and throughout the remainder of his life he continued to be engaged in railway engineering work.

NOEL EDGELL BROOKS, M.E.I.C.

From August 1889 to September 1890 he was resident engineer on the construction of the Qu'Appelle-Lake Long and Saskatchewan Railway. During the next year he was resident engineer on the construction of the Calgary and Edmonton Railway, following which he was engaged on the construction of the Crow's Nest Pass Railway. In June 1892 he returned as resident engineer to the Calgary and Edmonton Railway, and in the fall of the same year occupied the same position on construction at the Crow's Nest Pass. In 1894 he was appointed assistant on construction to the chief engineer of the Montreal Electrical Street Railway, and two years later was appointed inspector on the Calgary and Edmonton and other railways in western Canada. From this position he became inspector for the bondholders of these railways, and in 1903 he was superintendent of maintenance-of-way and structures while these railways were operated by the Canadian Pacific Railway Company. In November 1903 he became division engineer on the western division of the Canadian Pacific Railway, with headquarters at Calgary, and during 1912-13 he was acting general superintendent of the Alberta division of the same company. He was then moved to Winnipeg, occupying the position of engineer maintenance-of-way of western lines, and 1915 retired on account of his health.

The late Mr. Brooks joined The Institute as Student on April 28th, 1887, transferred to Associate Member on November 20th, 1890, and to Member on December 9th, 1897.

Edward Thornbrough Parker Shewen, M.E.I.C.

In the death of Edward Thornbrough Parker Shewen, M.E.I.C., which occurred at St. John, N.B., on December 9th, 1926, The Institute has lost another of its first members; one who was enrolled in the membership list of the Canadian Society of Civil Engineers on January 20th, 1887, prior to its incorporation.

The late Mr. Shewen was born at Brockhurst, Hants, England, in 1849, and was educated at the Royal Naval School and by private tuition. He was one of the English army engineers who came to Canada about 1870 and settled in Nova Scotia. His first work in Canada was as assistant engineer on the Louisbourg Railway. Later he was engaged on railways, surveys and construction in various parts of Nova Scotia. In May 1879 he was appointed resident engineer on the Halifax and Cape Breton Railway. In 1883 he was employed by the Nova Scotia Government as assistant engineer with the bridge department, and in the same year joined the staff of the Department of Public Works of the Nova Scotia Government.

He moved to St. John in 1895, becoming resident engineer with the federal Department of Public Works and continuing in that position until 1911, when he retired on account of ill health. Since that time he has been acting in the capacity of consulting engineer. As resident engineer in St. John he was responsible for many of the original projects and harbour construction schemes and river improvements throughout the maritime provinces.

William Robert Pilsworth, M.E.I.C.

In the death of William Robert Pilsworth, M.E.I.C., which occurred at his home in Vancouver, B.C., on November 13th, 1926, The Institute has lost one of its early members, whose election as Associate Member of the Canadian Society of Civil Engineers took place on May 18th, 1888.

The late Mr. Pilsworth was born at Willsgrove, County Kildare, Ireland, on July 26th, 1849, and came to Canada at a very early age. His first engineering work was with the Canadian Pacific Railway Company in the junior capacity of rodman and leveller for four years, from 1879-1882. For the following two years he was engaged as assistant engineer with a firm of contractors in Toronto on harbour improvement work in that city. Subsequently he was engaged with contractors on the enlargement of the Welland Canal until the end of 1886. The following year he returned to Toronto, where he was first connected with the Gravitation Survey in connection with the water supply to the city from lake Simcoe, then as assistant engineer on the staff of the chief city engineer, during which period he was in charge of the Ashbridges Bay improvement works, later being engaged on the survey of Toronto island and harbour.

In 1898, he was appointed division engineer in charge of construction on the Columbia and Kootenay Railway, following which he was chief engineer of the Thompson Valley Power and Irrigation Company. In 1901, he was appointed engineer in charge of the construction of the Thompson river bridge for the British Columbia government. In 1902, he was in charge of the party on the survey of structures for the mountain division of the Canadian Pacific Railway Company, later being engaged on surveys and plans for proposed irrigation scheme in British Columbia. From 1903-06, he was with the Canadian Pacific Railway Company and was engaged in irrigation work in Alberta. He joined the British Columbia Electric Railway Company in 1906, during which time he located the Burnaby lake line and the extension of the Capilano line. He entered private practice at Kamloops in 1909, and in 1911 was appointed district engineer of the Kamloops district for the Water Branch of the Lands Department of the British Columbia Government. During the Riel Rebellion in 1885 he was Captain of the Winnipeg Light Infantry.

The late Mr. Pilsworth remained an Associate Member of the Canadian Society of Civil Engineers until October 8th, 1903, when he was transferred to Member.

Benjamin James Forrest, M.E.I.C.

Benjamin James Forrest, M.E.I.C., died at his home in Montreal on November 19th, 1926.

A native of Scotland, Mr. Forrest was born at Begbie, Scotland, on November 24th, 1860. He received his early engineering training as apprentice to Messrs. Higson and Francis, civil engineers, and later with Messrs. Fawcett Preston and Company, mechanical engineers. His apprenticeship covered a period of six years. He then was appointed assistant engineer to the chief engineer of the Bilboa Railway and Iron Mining Company in Spain, where he was engaged for five years on the construction of railway projects, harbour works and other general construction work for the company. Subsequently he was engaged on similar works in Argentina and Brazil, and later on railway and preliminary work in Costa Rica.

On coming to Canada, he first went to Toronto, where he was engaged on mine surveys and reports. He then joined the staff of the Dominion Iron and Steel Company at Cape Breton, being engaged on prospecting and surveys. His next work was in connection with railways and mines on the construction of plant and harbour facilities at Port Hastings. From 1904-06 he was with Messrs. Mackenzie and Mann, Limited, on railway and harbour construction for the Inverness Railway and Coal Mines. Later he was with the Public Works Department at St. John on inspection work. In 1906 he was appointed division engineer on the construction of the Guelph and Goderich branch of the Canadian Pacific Railway Company, and in 1909 became resident engineer for the same company on the main line in the vicinity of Winchester, Ont. The following year he occupied a similar position on the inspection of the Quebec Central Railway.

Subsequently he was engaged on electric railway and power development work at Berlin and Guelph, Ont., and in the latter part of 1911 was on the staff of the Canadian Inspection Company in Montreal. His later work included construction and inspection with the Canadian Pacific Railway Company, the Canada Steel Corporation at Windsor, Ont., the Asbestos Corporation at Thetford Mines, the Montreal Harbour Commission and the Hollinger Mining Company.

Mr. Forrest was a member of the Canadian Institute of Mining and Metallurgy and was at one time an Associate Member of the Institution of Civil Engineers of Great Britain and of the Mining Society of London, England. He was admitted to the Engineering Institute of Canada as Member on January 14th, 1904.

ELECTIONS AND TRANSFERS

At the meeting of Council held on December 14th, 1926, the following elections and transfers were effected:—

Member

LeROY, William Lindsey, with H.E.P.C. of Ont., superintending power house constrn. at the Queenston-Chippawa Power Development, Queenston, Ont.

Associate Member

MOUNTFORD, George Colledge, mech. supervisor, Ont. Power Plant, Niagara Falls Hydro-Electric Power Co., Chippawa, Ont.

Juniors

COOIL, Thomas Reginald, B.Sc., (Univ. of Sask.), instrumentman with City of Saskatoon, Saskatoon, Sask.

PARKER, Charles Alexander, B.Sc., (McGill Univ.), English Electric Co. of Canada, Montreal, Que.

Affiliate

PALMER, Leonard Charles Dunlop, 1st vice-president Wm. Hamilton Ltd., Montreal mgr. in charge Eastern Canada, Montreal, Que.

Transferred from class of Associate Member to that of Member

WOLFF, A. Oscar, resident and division engr., C.P.R., Brownville Jct., Maine, U.S.A.

Transferred from class of Junior to that of Associate Member

BOWMAN, Charles McCawley, commercial engr. with Mar. Tel. and Tel. Co., Halifax, N.S.

McPHAIL, Donald Stuart, B.Sc., (McGill Univ.), executive engr. i/c hydraulic project division of the Mandi hydro-electric scheme, Lahore, India.

Transferred from class of Student to that of Associate Member

GREENWOOD, William, B.Sc., (Queen's Univ.), New Liskeard, Ont.

MILLS, Arthur McTavish, B.Sc., (Queen's Univ.), asst. to res. engr., Dept. of North. Development, Ont., Cochrane, Ont.

Transferred from class of Student to that of Junior

MacNAUGHTON, Moray Fraser, B.Sc., (McGill Univ.), ch. inspector on constrn. of sub-structure Mtl. South Shore bridge for Milton Hersey, Westmount, Que.

SPRIGGS, William, B.Sc., (McGill Univ.), on relay protection with Shawinigan Engineering Co., Montreal, Que.

VALIQUETTE, Charles, C.E. and B.A.Sc., (Univ. of Mtl.), asst. road engr. constrn. and mtce., Road Dept. of Prov. of Que., Outremont, Que.

VARDON, Lester Milton, B.A.Sc., (Univ. of Toronto), engr. on traffic statistics with Toronto Transportation Commission, Toronto, Ont.

New Construction Tendencies

An interesting article by James Govan, R.A.I.C., consulting architect, Toronto, entitled "New Construction Tendencies and their Probable Effect Upon Canadian Architecture," has been issued in reprint form following its publication in the Journal of the Royal Architectural Institute of Canada.

The General Supply Company of Canada, Limited, have entered into an agreement with the Automatic Transportation Company, Inc., of Buffalo, N.Y., to control the basic patents relative to the manufacture and production of storage battery electric truck and tractor equipment, whereby they become the exclusive Canadian distributors for that company. The Canadian sales of this equipment were previously handled by Mr. H. S. Powley, of Toronto, Ont., who has now entered the services of the General Supply Company.

CORRESPONDENCE

Engineering Features in Breaking the Allegheny Ice Gorge

Ottawa, December 9th, 1926.

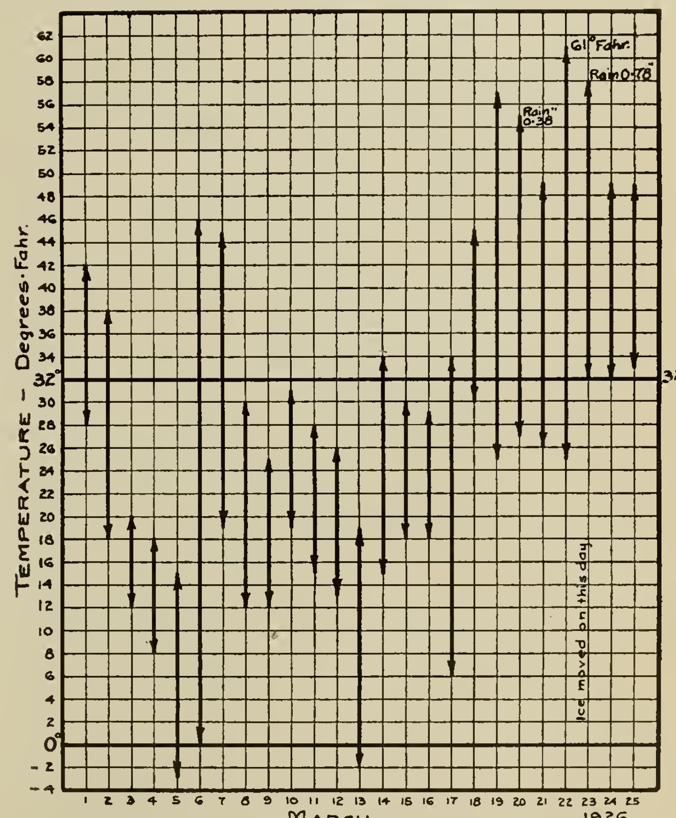
The Editor (*The Engineering Journal*)—

Dear Sir:—

Referring to Dr. Howard T. Barnes' address entitled "Engineering Features in Breaking the Allegheny Ice Gorge," I beg leave to present the following statements:

The excellent ice work which Dr. Barnes has accomplished needs no word of praise from me at this moment. I have praised it wholeheartedly all over the country at more than two score meetings of engineers, scientists and hydraulic power plant operators. His work has been more help to me in my own ice problems than any other work of which I have ever heard.

In his address on the use of thermit in the Allegheny river, he makes mention of the ice-melting action of the sun and rain,—but does he give enough credit to those enemies of ice? He found the river gorged with ice for 25 miles, and reading the Engineering Journal's report of his work, with a copy of the accompanying weather chart, which I have prepared alongside of that report, it seems that only about 5,000 feet of river-length, (out of 25 miles of ice), was cleared of ice with dynamite and with thermit up to the middle of March, simply because the weather remained very cold.



The Allegheny Basin—Temperature Records.

Figures taken from the U. S. Dept. of Agriculture's "Climatological Data." Only four clear days in February, 1926. Snow = 19.6 inches.

Co-incident with the arrival of warm weather, about March 18th, (see the diagram), the weakening of the ice gorge proceeded at a great pace and on the 20th, to the accompaniment of 0.38-inch of rain, the whole upper pack moved.

With air temperatures ranging from 49° to 61° Fahrenheit in the next three days, and with a rainfall of 0.78-inch on the 23rd, the whole gorge was released.

I regret that Dr. Barnes was not so aided in his stupendous task on the Allegheny river that he could have secured water-temperature measurements with his micro-thermometer, because I feel he would have secured very valuable data.

While not disparaging what he did accomplish with thermit, I am compelled to ask: Does he give sufficient credit to the ice-melting work done by the sun, air and rain in the Allegheny basin?

JOHN MURPHY, M.E.I.C.

The Work of the Canadian Engineering Standards Association

During the first six years of its existence, this association established a record of satisfactory achievement, but its activities were unfortunately somewhat checked in 1925, owing to the withdrawal at that time of the grant hitherto received from the Dominion Government. The National Research Council, however, recognizing the importance of the association's work, has been able to furnish means for the complete resumption of its activities, upon the understanding that additional support will be obtained from Canadian industry. A programme of increased usefulness and further development is thus rendered possible, and is now being carried on. Particulars of the work already accomplished and the projects now in hand will be contained in the report to council which is furnished annually by the three members nominated on the main committee of the C.E.S.A. by the council of the Institute.

The following extracts from the forthcoming Year Book of the Canadian Engineering Standards Association set forth in concise form so many pertinent features of standardization work that no apology is needed for their presentation to readers of the Engineering Journal at this time.

Industrial Standardization

Industrial standardization has been classified under the following heads:

1. Selection of standard terms, nomenclature and definitions.
2. Agreement on standards of quality, resulting in uniformity of specifications and requirements of purchase, and in methods of testing and rating.
3. Selection of suitable standard dimensions and tolerances, thus insuring interchangeability of parts, economy of manufacture or assembling, and satisfactory operation.
4. Elimination of unnecessary sizes, grades and types of product, making for simplicity of manufacture, economy in stock carried and the lessening of sales costs.
5. Selection of standard rules or requirements necessary for the safety of employees and the public.

The purpose of the Canadian Engineering Standards Association is to provide the facilities by which manufacturers and users of engineering materials can get together and formulate mutually satisfactory standards. It has had the support of the Government from the beginning, and also a considerable measure of assistance from the industries, and as a result of its activities a number of important standards have already been nationally adopted. It is as yet only at the commencement of its work, and a vast field is open in which further standardization can be undertaken with the greatest advantage to the manufacturers and users in Canadian industry.

Success in manufacture is becoming more and more a question of the ability to employ mass production as against specialized production in any article. It may be objected that conditions in Canada do not lend themselves to mass production as practised in the United States or other large manufacturing countries where the demand for any one product is many times greater than with us, and there is no doubt that in many respects this is true. The economies effected by mass production are, however, largely those attendant on the continual production of similar articles as contrasted with the production of a constantly changing series of articles, and, by industrial standardization, many of these advantages may be obtained even though the aggregate output is comparatively small.

In the production of a standardized article, economies are effected through the avoidance of new designs and drawings, by the simplicity in making out orders, by the familiarity of everyone in the plant with the article required, by the ability to produce large quantities as one set-up, and by the reduction in the stock required to fill orders.

As far as the standardized article is concerned, both manufacturers and users are benefited by avoidance of varieties in design and qualities that are not of vital importance but largely demanded by personal ideas or the lack of a definitely established standard to determine the choice between one article and another.

Even in the case of railroad bridges and steel structures where mass production in any sense of the word would be an impossibility, the establishment of the C.E.S.A. standard has been of decided advantage in those bridges and structures that are not of extraordinary design or highly specialized. The user, by ordering in accordance with C.E.S.A. standard, is assured of a thoroughly well-considered and satisfactory specification without the work and expense of preparing it, and as it has been agreed on by the manufacturers, one in which there are no extra charges or annoying complications. The manufacturer benefits by the work not only in regard to methods of estimating, calculating and design with which his staff is thoroughly familiar, but by the use of standard material, and by his workmen becoming accustomed to the established practice.

To consider a widely different class of standardization, the case of stove bolts may be instanced, for which the C.E.S.A. standard has defined seven standard sizes, uniform threads, and uniform tolerances, in place of the great variety that formerly existed. In selecting a bolt for any desired purpose, the user has a choice of a definite number of agreed on sizes, in place of the entire range quoted in a typical trade catalogue. If a special bolt is necessary, it can still be obtained by special arrangement, but if, on the other hand, one of the standards adopted will suit his purpose, he will be using an article that will be more cheaply produced, more promptly delivered and obtainable at any time.

These are only two examples of the benefits obtainable by industrial standardization, but they serve to illustrate the field of activity that is available in this line of work.

Method of Work

The C.E.S.A. standards are not originated by the association or its staff, but by working committees which the association organizes on which manufacturers and users nominate the majority of the members. These representatives take part in the actual discussion of the problem, and handle the technical work. The results, on which all interests concerned are therefore in agreement, thus carry with them no idea of compulsion, and are adopted and used by reason of their inherent suitability and advantage. The standard as proposed is finally submitted to the main committee of the association, which satisfies itself that full consideration has been given to the subject and that all interests have been adequately represented before it authorizes publication by the association.

The services of the committee are also available for the periodical revision of their reports, and when it appears advisable to revise any standard, the procedure adopted in the preparation of the original standard is adopted. If necessary, however, the membership of the committee may be augmented to include interests not previously represented, but whose co-operation would assist the committee in its deliberations. This obviates any risk of retaining a standard in use after improvements or changes of practice have rendered it obsolete in any respect. The association does not assume the rôle of a director, but rather of a co-operative body, and therefore must be guided in its operations by the requirements of the manufacturing or industrial interests represented on its committee.

Co-operation with Foreign Standardizing Bodies

Standards as published, tentative specifications, and progress reports on standardization projects are freely exchanged with the other national standardizing bodies. These reports are prepared semi-annually and are made on a form adopted as standard by all the bodies. The various secretaries are in continual communication with each other and many matters of mutual interest are discussed. Two international conferences of secretaries have been held, the first in London in 1921, and the second in Zurich in 1923. An international conference was held in New York in 1926 in connection with the meeting of the International Electrotechnical Commission, and many of the foreign secretaries were present. The secretary of the Canadian Engineering Standards Association attended all three of these conferences.

Co-operation with the British Engineering Standards Association and with the American Engineering Standards Committee is naturally much closer than with other bodies. In the case of the B.E.S.A. tentative specifications are published, standards are received and submitted to interested members of the C.E.S.A. for criticism. Comments received are sent to the secretary of the B.E.S.A. for transmission to the various committees concerned. It has been found that in many cases these have been very helpful. A small stock of the publications issued by the B.E.S.A. is kept on file and copies are on sale by the secretary.

With the A.E.S.C., co-operation is carried on by the exchange of minutes of committee meetings in some cases, by the appointment of representatives who act as observers on committees, and by correspondence between the secretaries. Copies of any standard issued by the A.E.S.C. can be obtained through the secretary of the C.E.S.A., but no stock is kept.

Field Open to Operation

Conditions in Canada are peculiarly favourable to an organization such as the Canadian Engineering Standards Association, for the reason that industrial standardization is in its infancy and the development of simplified practice has never been seriously attempted.

In the United States the work of national standardization is handled by the American Engineering Standards Committee, but simplified practice comes under the jurisdiction of the Federal Department of Commerce. In Canada, however, both these matters can be handled by one organization, namely, the C.E.S.A. In Great Britain the work of the British Engineering Standards Association is being extended more and more into the field of simplified practice and the benefit to industry has been remarkable.

Work Accomplished

The Canadian Engineering Standards Association has published nineteen standard specifications to date, which have been largely adopted, and in many cases are Dominion Government standard.

ABSTRACT OF PAPER

The Okanagan and Its Problems

Major J. C. MacDonald, Comptroller of Water Rights, Victoria, B.C.
Victoria Branch, November 3rd, 1926

Major MacDonald remarked that while he had been in close touch with the irrigation affairs of the interior for the last seven years, covering developments in the Lillooet district, the Okanagan, and the Princeton and Grand Forks districts, the engineering features had not included structures of any great cost or interest, but were interwoven with the other economic features. As affecting the returns from orchards in the Okanagan he would place marketing, production, and irrigation water costs, in the order of precedence given.

At its very best, the marketing of the crop was an extremely difficult affair, and if from any cause, such as surplus supply at any point, or independent shipping, the price was cut, it was practically impossible to bring it up to a fair level again. Potatoes, as a necessity, would be purchased at any price within range, but apples, as a luxury, could be done without. This year, for instance, the prairie market fell to pieces, owing to the unfortunate weather that occurred in September, which held up the threshing, reduced the quality of the grain, and left the roads in such condition that only necessary transport took place.

An outline was given of the efforts that had been made to overcome these marketing troubles, and it was pointed out that assuming an irrigation cost of five cents per 40-pound box of apples, it was easily seen that the range of the market price was of vastly more importance than the cost of irrigation water.

Similarly in regard to production, returns might vary from 100 boxes to 600 boxes per acre, with a general average of perhaps 300 boxes. Assuming the cost of irrigation water at 20 boxes per acre, it was evident that the productivity of the orchard was of the greater importance.

A brief history of the development and growth of the fruit industry was given, and the circumstances that led up to the call for assistance by the growers under several systems, and the establishment by the government of the Conservation Fund, were outlined.

The detail allocation of money received from this fund had been placed in the hands of the districts themselves, but the expenditure had to be checked by the speaker as superintendent of construction, to insure that there was no waste or extravagance. This method of dealing with the moneys insured that the government had not built costly works and then charged them to the water users.

The poor returns from the crops of 1922 started a crusade for relief from some portion of the repayment charges, and a two-year moratorium was granted the payment of interest, and the payments on account of permanent (30-year) structures being carried over, to be funded afterwards. This was of considerable assistance; but a further difficulty arose later. The repayments from any particular district were spread over a certain number of irrigable acres. Where land reverted to the district for non-payment of water taxes, the amount due from the reverted lands had to be added to the paying lands, with a resultant increase in irrigation water cost; and it soon became evident that this added burden might become unbearable.

It has therefore been devised that on land becoming delinquent, if it is not sold within a reasonable time, the title is transferred to the government, and the government accepts responsibility for the charges assessed against that area. These lands are dealt with by the lands department, as reverted Crown Lands, and sold at such price as may be determined, the purchaser assuming the responsibility for further repayments to the Conservation Fund.

In this way, no owner can be called upon to pay more than the actual cost of delivery of water to his own land.

The latest returns show:—

Irrigation districts	18
Water users communities	10
Companies	6
Under municipalities	2
Government project	1
Total	37

And the estimated irrigable areas under present works are as follows:—

	Irrigable areas. (acres)
Co-operative irrigation organizations, assisted financially by the Government	34,800
Co-operative irrigation organizations not assisted by Government	4,700
Under company control	17,500
Under municipal control	8,600
Government project	10,000
Total	75,600

ANNOUNCEMENT OF MEETINGS

CALGARY BRANCH

Secretary-Treasurer, H. R. Carscallen, A.M.E.I.C.

Jan. 6th: Annual Dinner.
Jan. 20th: Address on "Kimberley Mines, B.C.," by B. L. Thorne, M.E.I.C.
Feb. 4th: Address by R. W. Boyle, M.E.I.C. (Subject not yet available.)
Feb. 17th: Address on "Oil Situation in Alberta," by C. C. Ross, M.E.I.C.
Mar. 4th: Address on "The Development of the Art of Communication," by A. M. Mitchell.
Mar. 12th: Annual Meeting.

LETHBRIDGE BRANCH

Secretary-Treasurer, N. H. Bradley, A.M.E.I.C.

Jan. 8th: Address by Mr. K. McKenzie. (Subject not yet available.)
Jan. 22nd: Address on "The Water Power Sites of the Crow's Nest Pass," by A. L. Ford, M.E.I.C.
Feb. 5th: Address on "The Irrigation Possibilities of South Eastern Alberta," by B. Russell, M.E.I.C.
Feb. 19th: Address on "Artillery Development in the Great War," by Brig.-Gen. J. S. Stewart.
Mar. 5th: Address by Prof. R. S. L. Wilson, M.E.I.C. (Subject not yet available.)
Mar. 19th: Annual Meeting.

MONCTON BRANCH

Secretary-Treasurer, V. C. Blackett, A.M.E.I.C.

January: Address on "Concrete in Sea Water," by A. G. Tapley, A.M.E.I.C.
February: Address on "Various Phases of the Official Life of a Public Works Engineer," by T. J. Locke.
Mar. 29th: Address on "Gunnery," by John Stephens, M.E.I.C.
Apr. 26th: Address on "Modern Tendencies in Highway Construction," by E. O. Turner, A.M.E.I.C.

VANCOUVER BRANCH

Secretary-Treasurer, F. P. V. Cowley, A.M.E.I.C.

Feb. 2nd: Address on "Education and the Mining Engineer," by J. M. Turnbull, B.A.Sc.
Feb. 9th: Address on "Coast Range of British Columbia," by Dr. V. Dolmage, B.A.Sc., Ph.D.
Feb. 16th: Open date.
Feb. 23rd: Open date.
Mar. 2nd: Address on "Education and the Legal Profession." (Speaker not yet definitely arranged.)
Mar. 9th: Address on "Recent Advances in Metallurgy," by Prof. H. N. Thomson, B.Sc.
Mar. 16th: Open date.
Mar. 23rd: Address on "The Work of the Vancouver and District Joint Sewerage and Drainage Board," by J. M. Begg, A.M.E.I.C.
Mar. 30th: Open date.

BRANCH NEWS

Border Cities Branch

C. G. R. Armstrong, A.M.E.I.C., Secretary-Treasurer.

Annual Meeting

The annual meeting of the Border Cities Branch was held Friday, December 10th, 1926, at 6.30 p.m., in the Prince Edward hotel, Chairman A. J. M. Bowman, A.M.E.I.C., presiding.

The minutes of the previous meeting were read and adopted, and the annual reports of the following committees were then presented and accepted:—Membership, by A. E. West, A.M.E.I.C.; Papers and Entertainment, by W. B. Pennock, Jr.E.I.C.; By-laws, by H. Thorne, M.E.I.C., and the reports of the Secretary and Treasurer, by Will H. Baltzell, M.E.I.C. Chairman A. J. M. Bowman, A.M.E.I.C., then reviewed the activities of the branch during the past year, giving many valuable suggestions for the ensuing year.

The election of officers for the year 1927 was then proceeded with, resulting in the following being elected:—L. McGill Allan, A.M.E.I.C., chairman; Harvey Thorne, M.E.I.C., vice-chairman; C. G. R. Armstrong, A.M.E.I.C., secretary-treasurer. O. Rolfson, A.M.E.I.C., A. E. West, A.M.E.I.C., and E. G. Ryley, A.M.E.I.C., were elected members of the executive committee. The ex-officio members for the year are A. J. M. Bowman, A.M.E.I.C., and Will H. Baltzell, M.E.I.C.

Mr. Pennock recommended that two committees be formed instead of the present Papers and Entertainment Committee, i.e., a Papers Committee and an Entertainment Committee.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, Jr.E.I.C., Branch News Editor.

Executive Meeting, November 23rd

A meeting of the executive of the Hamilton Branch was held on November 23rd in the office of W. L. McFaul, M.E.I.C., city engineer, eight members of the executive being present. The meeting was mainly devoted to routine matters. It was decided to make the meeting to be held on November 25th open to the public on account of the general nature of the subject. An expenditure of about $12.00 was authorized to advertise the meeting in the local papers.

A communication from the general secretary of the Institute regarding a revision of the conditions under which students' prizes are awarded was referred to a committee composed of H. B. Stuart, A.M.E.I.C., and J. R. Dunbar, Jr.E.I.C.

The Geology of the Hamilton District

A meeting of the Hamilton Branch was held in the auditorium of the Hamilton Technical Institute on Friday, November 25th, 1926. The speaker of the evening was Professor A. P. Coleman, M.A., Ph.D., F.R.S., who had been for thirty-one years head of the geological department, University of Toronto. Dr. Coleman is now retired but keeps up an active interest in geology.

On account of the general interest of Dr. Coleman's subject, "The Geology of the Hamilton District," the meeting was thrown open to the public and when the meeting was called to order there were 180 present, including several ladies and the representatives of the local press.

Before the address a vocal solo was rendered by Mr. J. C. Hodges, a teacher at the Hamilton Technical Institute, who was accompanied by Miss Doris Stock.

L. W. Gill, M.E.I.C., chairman of the branch, introduced Dr. Coleman, who commenced his address by congratulating the city on its magnificent technical school. He declared that Hamilton should be proud of the institution.

The history of the deepest layer of the foundations of Hamilton dates back one thousand millions of years. This has been ascertained by drilling which was carried out for gas in the vicinity of Toronto near lake Erie. Under Toronto, granite was found at a depth of 1,200 feet and under lake Erie at a much greater depth. Drilling has not been actually carried out in Hamilton, but there is no doubt that granite is there, since Hamilton lies between Toronto and lake Erie. The drilling has greatly aided the study of the geological history of the region. The granite was originally the mountain surface. Then a change came, and where Hamilton now is there was a shallow sea with mud at the bottom, which is now changed to shale. That was, say, 500 millions of years ago, which Dr. Coleman referred to as comparatively recent times. Sometimes the water was clearer, when limestone was formed from plants and small animals. Sandstone showed where rivers had rolled down and ground rocks to fragments. There is not much sandstone in the neighbourhood of Hamilton. The sea that covered this region appears to have had a bottom that was slowly settling down. Near Hamilton material was deposited to a depth of 300 feet in layers which turned into various kinds of rock. This can be studied by a visit to the Hamilton mountain, which is called an "escarpment" by geologists.

Dr. Coleman showed pictures, on the screen, of the creatures that inhabited this region billions of years ago when the world was young.

Coming forward to a period only two or three million years ago, he showed a map on which was marked a river flowing from Barrie through Newmarket and Richmond Hill, across Ontario and on down to the sea. It actually existed once and had a tributary that flowed between Dundas and Hamilton. Sounding showed that in those days there really was a mountain here around 2,500 feet high. There were no great lakes then. This river was known as the Laurentian and flowed well out into the gulf of St. Lawrence.

The cliffs of the Hamilton escarpment are very useful in tracing the history of the region. Ice 3,000 feet thick once covered this district. For thousands of years it remained so. Showing a picture in the moraines in the Dundas valley, the speaker said that only ice in the form of glaciers could produce that hummocky landscape. Boulder clay and striated stones, such as are found in this district, are evidence of the passing of a glacier. Hamilton was well within the boundaries of the immense glaciers.

Finally the ice retreated, and as it retreated it blocked the river valleys. The Kingston region was left buried after the ice had retreated from the local district. During this period, two great lakes were formed; lake Algonquin, which approximately covered the area now occupied by the upper lakes, and lake Iroquois, which approximately covered the area at present occupied by lake Ontario.

The ice wall at Kingston blocked the outlets of these down the old Laurentian valley, and of course new outlets were found. At different times during this period the water of the upper lakes found outlets down the Mississippi, down the Ottawa, flowing out through the present Georgian bay into lake Ontario, past Trenton and down the present Hudson river through lake Ontario. Practically all these original water courses had been advocated from time to time by various engineers for canal routes.

The gravel bar over which the high level bridge out of Hamilton is built and Dundas bay above the bar, corresponded exactly in the old lake Iroquois to Burlington beach and Burlington bay in the present lake Ontario. This gravel bar is one of the wonders of lake Ontario and Dr. Coleman hoped that it would not all be used up for building material.

From the excavations for the old Desjardins canal, traces have been found of the cariboo and the reindeer. Bones of elephants, (mammoth or mastadon), and the musk-ox, have also been found.

Then the level of the country was lowered and the sea came in, and Hamilton was nearly a seaport, the sea being only five or ten miles away. The gulf of St. Lawrence reached almost to Hamilton. Sea shells were found as far up as Brockville, but the fresh water nearer here was at the same level.

After the sea withdrew, Niagara falls began its work. The falls began at the escarpment. It had cut its way back seven miles. He showed a slide of the first picture of Niagara falls, taken 350 years ago. There was no horseshoe then, and the horseshoe has now changed into a point. Unless some engineering effort is made, the time will rapidly come when the plunge will be replaced by rapids. The horseshoe falls are cutting the land away at the rate of four and a half feet a year. By this calculation it was figured that the falls began 7,000 to 8,000 years ago. That was when the ice age ended. The American falls are wearing away at the rate of only two inches a year.

In concluding, Dr. Coleman expressed a hope that the water of the Great Lakes would not be diverted past Chicago and that engineers would find a means of preventing Niagara falls from becoming a rapids.

At the conclusion of Dr. Coleman's remarks, Mr. John Wallace, a local geologist, stated that steps were being taken to preserve the gravel bank which formed the gravel bar in lake Iroquois.

A hearty vote of thanks was accorded the speaker on the motion of H. A. Lumsden, M.E.I.C., county roads engineer, seconded by W. L. McFaul, M.E.I.C., city engineer. The meeting closed with the singing of "God Save the King," with E. M. Coles, A.M.E.I.C., at the piano.

Executive Meeting, December 6th

A short meeting of the executive of the branch was held in the office of W. L. McFaul, M.E.I.C., to discuss final arrangements for the meeting to be held on December 14th.

Reports on three applicants for admission or transfer for higher grade in the Institute were received from the membership committee and were approved.

A letter from the general secretary of the Institute regarding co-operation between the Engineering Institute of Canada and the local Board of Trade was read and considerable discussion followed. It was finally decided to forward a copy of the letter to the local Chamber of Commerce stating that the Hamilton Branch were willing to co-operate and asking what action they wished to take.

Regular Meeting, December 14th

A meeting of the Hamilton Branch was held in the cafeteria of the Hamilton Technical Institute on Tuesday, December 14th, with L. W. Gill, M.E.I.C., presiding. During the evening musical numbers were provided by different students. These included a vocal solo by Leslie Emery accompanied by his sister, and several selections from the school jazz orchestra, led by Mr. J. Sloan.

The Manufacture of Carbon Products

The subject for the evening was "The Manufacture of Carbon Products," which was presented in a very interesting and instructive address by J. C. Webster, now sales engineer for the Canadian National Carbon Company in Toronto, and formerly connected for several years with the Carbide and Carbon Research Laboratories of Cleveland, U.S.A.

The address was comparatively brief, but it was made very interesting by means of a film entitled "Behind the Pyramids," which showed the various stages in the manufacture of carbon brushes, from the raw materials to the finished product. The list of the principal raw materials used in the manufacture of the various carbon products includes lamp-black, petroleum coke, artificial and natural graphite, and the various pitch and tar binders, a group which is apt to appear small in variety to the uses of carbon, but the process of manufacture, the mixing, forming and baking of the carbon, gives to it the many variations which make it so useful electrically.

The specific resistance can be varied from 0.0004 to 0.004 ohms per inch cube, or a range of 10 to 1. This range can be still further increased by the use of metals such as copper. The hardness as measured by scleroscope can be varied from approximately 10 to 85, or a range of 8½ to 1. The contact drop can be varied from approximately 1¼ volts per brush to below 1/10 volt per brush. The co-efficient of friction can also be controlled, although not to so great an extent.

These changes in physical and electrical properties are accomplished by variations in the raw materials, in the methods of forming the carbon, and by the heat treatment after forming. By properly controlling the final temperature, identical raw materials will produce entirely dissimilar finished products.

Carbons are formed by two methods: first, a moulding process under hydraulic pressure, and secondly, an extrusion process by which the carbon-binder mixture is extruded from an hydraulic ram through dies of various sizes and shapes.

Two types of furnaces are used for the baking, known as the muffle type and the regenerative ring type respectively. The muffle type requires thirty-five days to complete the baking, whereas the regenerative ring type completes its cycle in about two weeks, and carries the carbon to a much higher temperature.

The film showed all the above operations, and in addition the inspection and finishing processes. The number of inspections and tests to which a carbon brush is subjected is astounding. Carbon can be worked to very close tolerances. In the case of round carbons, the minimum tolerance can be less than one mil, and in rectangular carbons less than two mils.

On the motion of J. J. MacKay, M.E.I.C., seconded by E. H. Darling, M.E.I.C., a hearty vote of thanks was tendered Mr. Webster.

After the technical part of the meeting was over, refreshments were served and all present joined in community singing, led by Mr. F. J. Evans, accompanied by E. M. Coles, A.M.E.I.C.

Lethbridge Branch

N. H. Bradley, A.M.E.I.C., Secretary-Treasurer.

If Sherlock Holmes had turned his talents as a sleuth toward an engineering career, he would undoubtedly have become a geologist. This must have been the impression of some at least who heard Dr. John A. Allan in his address on the evening of December 4th, before the Lethbridge Branch.

Geological Aspects of Spray Lakes Project

As professor of geology at the University of Alberta, it is the doctor's duty to know every rock in the province, know each intimately and by name. That he does know rocks and can paint a vivid picture of what they imply historically and in terms of practical utility, was evident to all who followed his discourse when he delved into the geological aspects of the Spray lakes power development near Banff.

Known, perhaps, more familiarly as an authority on our oil and gas resources, it is not generally known that for the past two years he has been doing the geological work on the big Spray lakes project, a power plant that will develop 40,000 horse power and estimated to cost over thirteen millions of dollars.

Dr. Allan's investigations have been devoted entirely to the geological features, ascertaining definitely the foundation material on which the huge dam will stand. The dam will be 170 feet high and 395 feet long and its stability will depend largely on its underlying bed. He has had to discover and define the class of material through which a tunnel two miles long will be driven. He has had to analyze the various soils that will be used in filling the dam. This work required much diamond drilling and in addition thirty hand-dug test holes, the samples secured being later subjected to careful laboratory experiments.

Speaking to an audience of engineers, his address was naturally of a highly technical nature. To the ordinary individual, such terms as mesozoic, jurassic, triassic, paleozoic, mean little, but to the doctor these words came glibly. They suggested profound problems that must be understood and determined before the tunnel could be driven, before the dam could be started and, in the final analysis, before the tired business man is enabled to snap a switch in his well ordered home, a switch that will bring to his elbow electrical current generated from water coursing through some mountain gorge hundreds of miles away.

Not showy work, this geology. The public sees little of it and understands less. After the doctor has completed his task, the construction engineer begins. Structural designs are made, and away off in Montreal or Toronto, steel is fabricated into great trusses and beams and these are shipped to the site of the work, a site that lies over rough trails in the midst of a mountain wilderness. Hundreds of men will labour for months as the dam takes shape. Other hundreds will bore through a mountain the tunnel that will be two miles long and twelve feet in diameter. There will be the great power houses to be built and a thousand miles or so of copper wire to transmit the power.

Such is engineering. After all these things are done, it is a simple matter to snap on a switch and get light.

His address was illustrated with slides, and among these were two showing the class of country that would be inundated by the 18-mile reservoir. It appeared to be desolate and barren. Covered with water, it will be a lake, a useful body of water that will add much toward progress in Alberta.

In the information given on a subject that is little understood by the public at large, Dr. Allan's address on the work of a geologist was intensely interesting. He was greeted by a large audience, and during the dinner which preceded the lecture the local engineers entertained with music by the Rainbow Orchestra, community singing, and songs by Chris Gibson and a violin selection from Mr. Vallance. In the absence of J. T. Watson, A.M.E.I.C., G. N. Houston, M.E.I.C., presided.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

"The Richibucto Cape Breakwater" was the subject of an address by Geoffrey Stead, M.E.I.C., at the regular monthly supper meeting of the branch, held in the Y.M.C.A. on November 30th. Mr. Stead, who is district engineer of the Dominion Public Works Department, was responsible for the design of this work, and was also engineer-in-charge of construction.

A. S. Gunn, A.M.E.I.C., chairman of the branch, presided, and there was a large attendance of members present.

During the course of the supper, the gathering was pleasantly entertained with vocal solos by Mr. Alonzo Johnson, of Dumbells, and banjo selections by Mr. G. H. MacQuarrie.

Richibucto Cape Breakwater

The speaker described, in detail, the progress of the work, his remarks being illustrated by maps and lantern slides. Special reference was made to shifting sand bars, which at times threatened to block the entrance to, and even fill the basin.

On being questioned as to the economic aspect of the work, Mr. Stead declared that expenditures for such projects were considered justifiable when the resulting annual increase in business was equal to the capital cost of the work. In the case of Richibucto cape, the value of fish products passing through that port had risen from $25,000 to $75,000 per annum. This increase was considerably in excess of the cost of the breakwater.

On the conclusion of the address, a vote of thanks was tendered the speaker, moved by H. W. McKiel, M.E.I.C., and seconded by C.

S. G. Rogers, A.M.E.I.C. The latter expressed the opinion that it should be a matter of pride to engineers that the profession included men who could plan so wisely and execute so admirably public works of great and lasting benefit to our Dominion.

THE SHAWINIGAN POWER FILM

Through the courtesy of Fraser S. Keith, M.E.I.C., of the Shawinigan Water and Power Company, the branch secured the loan of an historical four-reel film dealing with the development of power from the early days up until the present time. It was our intention to show this film immediately following Mr. Stead's address, but unexpected difficulties in obtaining a moving picture machine resulted in our being disappointed. For the information of branches that may have the good fortune to secure the film we might mention that there are two types of moving picture projectors in general use,—the Standard and the Pathe,—and it is the Standard machine that must be used when showing the Shawinigan film. Pathe machines we could get a-plenty, but only one Standard, and that one sadly in need of repair. Although strenuous efforts were made up to the very last to put the machine in order, the projector, with the proverbial cussedness of inanimate objects, stubbornly refused to "project." The film was later sent to Sackville and shown at one of the moving picture houses of that town for the benefit of the engineering students of Mount Allison. Unfortunately, similar arrangements could not be made in Moncton without interfering with the regular theatre programmes.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

USE OF DURALUMIN IN THE MANUFACTURE OF ALL-METAL ARTIFICIAL LIMBS

On Thursday evening, November the 18th, the branch was fortunate in having a paper on the subject of Duralumin, by N. F. Parkinson, A.M.E.I.C., deputy minister of the Department of Soldiers' Civil Re-establishment.

The author dealt in a general way with the development of artificial limbs, referring to wooden limbs, and giving a comparison in weight and durability between these and the latest all-metal artificial limbs manufactured of duralumin.

He gave particulars of physical tests, chemical composition, and heat-treatment of duralumin, together with a comparison with other metals, and mentioned that tests and experiments were originally carried out on this alloy by Professor Allan Polard, technical adviser to the British Ministry of Pensions. Reference was made to further experiments which are proceeding with other alloys, which may result in even greater improvements.

Samples of artificial limbs made of both wood and duralumin were exhibited, and which are now being manufactured at the Canadian Government's factory in Toronto.

Mr. Parkinson gave some particulars as to the number of amputation cases in the C.E.F. resulting from the war, and referred to some of the difficulties encountered in supplying suitable artificial limbs in the more complicated cases.

The paper was illustrated with lantern slides. Dr. H. T. Barnes, M.E.I.C., and F. P. Shearwood, M.E.I.C., took part in the discussion, and a vote of thanks to the speaker was proposed by J. A. McCrory, M.E.I.C. The chairman was J. L. Busfield, M.E.I.C.

HYDRO-ELECTRIC DEVELOPMENT OF BRYSON

An interesting paper was read on November 25th by H. E. Pawson, M.E.I.C., describing the development of the power on the Calumet channel of the Ottawa river near Bryson by the Ottawa River and Power Company. The ultimate capacity of this power was given as 75,000 h.p., with present operating capacity of 25,000 h.p.

It was constructed on the site of an old dam built by the government for logging purposes, and facilities were provided in the present dam by means of a log chute for the passage of logs. A full description was given of the construction of the dam and power house, illustrated by lantern slides. A useful feature of the construction was the provision of a gantry crane from the wharf-landing to the power house to facilitate the handling of heavy machinery. A large steel scow was specially built to transport construction material, machinery and equipment in cars from the nearest railway point on the river to the site of the power plant.

Mr. Pawson gave full details as to the construction costs of dam and power house, including camp and administration buildings used during construction operations.

D. C. Tennant, M.E.I.C., proposed a vote of thanks. Prof. C. V. Christie, M.E.I.C., was the chairman during the first part of the evening, but as he had to leave early, the chair was later taken by E. G. Burr, A.M.E.I.C.

RAILWAY SUPPLIES

"What is the Supply Department of the Railway Doing to Keep Pace With Other Prospective Units?" was the full title of a paper read on Thursday evening, December 2nd, by Mr. L. C. Thomson, director of stores, Canadian National Railways.

The writer stated that Canadian railways have to pay 30 to 35 per cent more for their supplies than railways in the United States, due, to a great extent, to taxes and import duties. Large quantities of material which run into high figures, such as coal, steel plates, boiler tubes, tires, etc., have to be purchased in the United States.

In referring particularly to the Canadian National Railways, he mentioned that they were somewhat handicapped owing to the fact that in the consolidation of these railways they had to maintain more repair shops than would otherwise have been necessary. It is the policy of the railway executive to maintain a three-months' supply of coal on hand, and large quantities of ties have to be stocked each year so that there may be plenty on hand in the spring to start work as soon as the weather permits. Large quantities of ties are also creosoted and have to be thoroughly seasoned before treatment. Mr. Thomson mentioned that fuel and ties were the largest individual items on their material balances. He described the modern methods of stock-keeping which had been instituted, resulting in considerable economy, whereby the stock balance on the railways, comprising the Canadian National Railways, was reduced from $25,000,000 before consolidation to $12,000,000 in October this year.

The paper was illustrated by moving pictures of railway stores and shops, showing methods of handling and issuing supplies, etc., which had been taken by the publicity department of the Canadian National Railways. A picture was also shown of a trip along the coast of Alaska.

Col. D. Hillman, M.E.I.C., chairman of the railway section of the branch, presided, and C. K. McLeod, A.M.E.I.C., proposed a vote of thanks to the speaker.

BUILDING FOUNDATIONS IN RELATION TO STREET LEVELS

On Thursday evening, December 9th, Geo. R. MacLeod, M.E.I.C., engineer-in-charge of technical service for the city of Montreal, read a paper on the above subject, illustrated by lantern slides.

The author, in referring to the many difficulties that the engineering department of the city has to overcome, stated that these would be largely obviated if owners would consult the department before starting on a project. In many cases, it is intended to change the existing levels of streets and sidewalks when re-paving the streets, so as to improve the grade or cross-section of the street. Under such conditions, if building plans in these localities are laid out to the existing elevations, they will not fit in with the proposed improvements.

It was pointed out that the by-laws allow the construction of foundations to proceed before a permit is obtainable from the city authorities. However, in the near future, it is expected that legislation will be secured to force the obtaining of a permit before ground is broken.

As instances of difficulties arising through failure to consult the city engineers, several of the larger structures of the city were mentioned.

SNOW REMOVAL

Following Mr. MacLeod's paper, J. LeBlanc, A.M.E.I.C., assistant engineer of the Montreal road department, gave a short paper on "Snow Removal," which was illustrated by lantern slides depicting the various types of equipment used by the city for this purpose.

Since the advent of motor cars and their use throughout the winter, the speaker mentioned that the task of snow removal had been enormously increased. In consequence, the machinery and equipment required for this purpose had been improving rapidly every year.

Mr. LeBlanc gave statistics of snowfall and cost of removal in recent years; the largest fall in the past four winters being 131 inches in 1923-24 and cost $1,231,124 for removal. Last winter, with a fall of 117.8 inches of snow, it cost $1,404,292 for removal. In the discussion which followed the paper, it was pointed out by Mr. LeBlanc that the cost of removal of snow is not always in proportion to the amount of the fall, due to the amount of ice which formed and general weather conditions.

The meeting was presided over by J. G. Caron, A.M.E.I.C., chairman of the municipal section of the branch, and a vote of thanks to the two speakers was proposed by Dr. Frigon.

ANNUAL MEETING

The annual meeting of the Montreal Branch was held on Thursday evening, December 16th.

After the meeting was called to order by C. J. Desbaillets, M.E.I.C., the retiring chairman, the secretary, C. K. McLeod, A.M.E.I.C., read the minutes of the last meeting.

In his address, Mr. Desbaillets called attention to the number of engineers that were leaving the profession to take up other more lucrative employment. He stated that the number of engineers at this meeting was a repudiation of this policy. He advised the students and young engineers who may be tempted to give up their profession to look back at the development of Canada in the past one hundred years, during which time there had been built extensive railways, vast hydro-electric installations, and water-storage systems, canals, bridges, industrial plants, etc. He also referred to the big development of the mines, steel and paper industries, and stated that in all this development the largest part was due to the efforts of the engineer.

Mr. Desbaillets referred to the Institute as the home of big ideas and wonderful conceptions, in which many engineers had delivered lectures describing great enterprises so that others might benefit from their experience.

In closing his address, Mr. Desbaillets expressed a vote of thanks to Mr. McLeod, the secretary of the branch, for his help and co-operation during his term of office.

The financial statement for the year was read by the secretary, in which he compared various items with those in last year's financial report. The statement showed a total revenue of $3,258 and a surplus of $1,637.

William C. Adams, M.E.I.C., chairman of the nominating committee, announced the results of the ballot for officers for the coming year as follows:—

C. V. Christie, M.E.I.C., chairman; F. C. Laberge, M.E.I.C., vice-chairman; J. G. Caron, A.M.E.I.C., D. C. Tennant, M.E.I.C., and D. Hillman, M.E.I.C., members of the executive committee.

In a short address, Mr. Christie thanked the members for electing him chairman of the branch. J. G. Caron, A.M.E.I.C., also expressed his thanks for his election as a member of the executive committee. The other members elected were not present at the meeting.

A vote of thanks to the retiring chairman and members of the executive was proposed by J. H. Hunter, M.E.I.C., and seconded by R. E. MacAfee, A.M.E.I.C.

J. A. Burnett, M.E.I.C., proposed a vote of thanks to the Papers and Meetings Committee, and read a list of papers to be read at the meetings during the first half of the coming year.

A vote of thanks to the Publicity Committee was proposed by P. L. Pratley, M.E.I.C. In his remarks he referred to the satisfactory way in which the press had reported the meetings, making particular mention of the French papers.

After a vote of thanks to the Reception Committee had been proposed by Geo. R. MacLeod, M.E.I.C., the meeting adjourned.

Refreshments were served after the meeting.

Programme of Meetings for the Spring Term

The Papers and Meetings Committee have been successful in arranging a very satisfactory programme for the spring term, the list of papers being as follows:—

Date	Subject	Author
Jan. 6	Water Cooled Furnaces	B. N. Broido
" 13	Mercury Arc Rectifiers	O. K. Marti
" 20	Vacuum Process for Paper Manufacturing	Ogden Minton
" 27	Railway Lands—Titles, Surveys, Leases and Taxes	F. Taylor
Feb. 3	Traffic Regulations by Automatic Signals	K. W. Mackall
" 10	Radium	Dr. Gendreau
" 17	Annual Meeting	
" 24	Student Papers	
Mar. 3	The Scientific Method in Industry	G. P. Cole, M.E.I.C.
" 10	Developments in Steam Boiler Design	F. A. Combe, M.E.I.C.
" 17	Locomotive Feed Water Heating	W. C. Hamm
" 24	Geology of Island of Montreal	A. Mailhot
" 31	Tele Vision	Dr. L. E. Pariseau
Apr. 7	Recent Development in Aviation	Mr. Reid
" 14	Manufacture and Uses of Carbon Dioxide	J. R. Donald, A.M.E.I.C.
" 21	Vallee Street Sub-Station	H. Milliken, M.E.I.C.
" 28	Gatineau Developments	A. H. White, M.E.I.C.

The members will note, amongst others, our old friend Dr. Pariseau, who is always very popular.

There are six out-of-town speakers who are all coming to Montreal specially to deliver papers before the branch. As the subjects are all of prime interest, it is hoped that large meetings will result.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

Annual Banquet

With a general air of jollity, with happy speeches and with hearty singing and enjoyable musical numbers, the annual banquet of the Peterborough Branch,—the night-of-nights for the local engineers,—was held at the Empress hotel on the night of November 23rd.

The branch has had the pleasure of entertaining many officers and past-officers of the Institute on the occasion of previous annual banquets. This year, among the guests, the branch welcomed a goodly representation of the council of the Association of Professional Engineers of Ontario, and the function might very properly be labelled "Professional Engineers' Night." Not only were the members of the branch afforded an opportunity of meeting some of the leaders who are working for the improvement of conditions within the profession, but also, in many cases, they heard for the first time some details of that great work, and so have a greater appreciation of what is being done for them.

About eighty members of the branch and guests were in attendance, the latter including many leaders of the profession from other branches of the Institute, and a number of prominent citizens of Peterborough. Throughout the evening, the members joined in singing well-known songs and parodies under the leadership of Paul Manning, A.M.E.I.C., past secretary of the branch, while a feature of the evening was the banjo selections given by Messrs. Wickwire, Ryan and Gore, while Ian MacKenzie presided at the piano.

The chairman of the branch, B. L. Barns, A.M.E.I.C., presided, and after welcoming the guests he referred to the value of such functions in bringing the members together. He then called attention to the objects of the Institute as set forth in the by-laws, pointing out the importance of each and responsibility resting upon each member in the fulfilment of these objects.

The secretary, W. E. Ross, A.M.E.I.C., read messages of felicitations and regrets at being unable to attend the banquet from Fraser S. Keith, M.E.I.C., Frederick B. Brown, M.E.I.C., Lt.-Col. Le Pan, A.M.E.I.C., Professor Peter Gillespie, M.E.I.C., and others. He then introduced N. E. D. Sheppard, A.M.E.I.C., assistant secretary of the Institute, welcoming him on the occasion of his first visit to the branch.

Mr. Sheppard brought greetings from headquarters and from a number of past officers of the Institute, and in his introductory remarks referred to the enviable reputation that the Peterborough Branch has made for itself, particularly in connection with its annual banquet. He pointed out that members of the branch should be proud of this reputation, explaining that, "Our Institute cannot be expected to thrive, or we cannot hope to carry out its objects unless there is that bond of good-fellowship, mutual esteem and confidence among its members which has its genesis in such functions as this."

Mr. Sheppard then gave a short résumé of Institute affairs and dealt with the problems being faced by the Institute, outlining the methods being used to solve some of them.

In closing, the speaker drew attention to the need for improvement in the status of the engineer, saying: "The question is persistently raised: why can't something be done to improve the status of the engineer? The question is pertinent,—the engineer is not recognized as he should be,—he does not get the credit that is due him for the important part he plays in the development of our country,—he should be the executive head of practically all our industries,—he should occupy the executive positions in all our works,—and he should be the leading factor in the administration of our country's affairs, in the direction of our municipal, provincial and federal governments. Why? Because his training qualifies him for these positions. But why does he not occupy these positions? Where does the fault lie? Not with our educational institutions, for their function is to teach him the fundamentals of science and how to apply them. Not with the general public or financiers or politicians, for they are all very much engrossed with matters of their own aggrandisement. Not with any of the factors outside of the profession, at whose feet the blame is often laid. The fault lies with the engineer himself, with each one of you gentlemen. Before the engineer can hope to be appreciated by those outside of the profession, he must appreciate himself and the engineers under him. He must place a higher value on himself. He must realize that this is the engineering age, the age of industrial development, and that with his training, his power to grasp a situation, analyze it and arrive at a sound decision, he has a tremendous advantage over others who have not that training. Now where does this lead? Once he realizes this advantage the field for the engineer becomes almost unlimited. He may enter any of our numerous industries, any of our financial and business houses, with the feeling that he is best equipped to learn that business and to ultimately direct its affairs.

"Then there is a component part of this thought,—the necessity for the engineer to take a far more active part in public affairs. As long as the engineer is so engrossed in his own work that he cannot give thought to or take part in affairs of a public nature, he will remain the very essential technical detailer for his own specialized line of work and he will be little known outside of his own small circle. How then can he hope for recognition,—what chance will he have for the appointment to an important post when, if by chance his name is mentioned, those making the choice can only say we never heard of him?"

Lt.-Col. H. J. Lamb, D.S.O., M.E.I.C., superintending engineer of the Ontario Department of Public Works, and president of the Association of Professional Engineers of Ontario, was introduced by A. L. Killaly, A.M.E.I.C., and brought greetings from the association, and in his opening remarks said: "The activities of this branch and the energy displayed by its members, has for many years stamped it as one of the most progressive branches of the Institute."

Before outlining the efforts being made by the Professional Engineers' Association to secure legislation in the province of Ontario, similar to that in force in practically all the other provinces, Col. Lamb paid tribute to the Engineering Institute, saying: "It is only right that, on behalf of the Association, I first pay tribute to the Engineering Institute of Canada for the prominent part which the Institute took, at the instigation of a few of its far-seeing members, in the initial work which eventuated in the passing of the Act in 1922 under which the Association of Professional Engineers of Ontario now functions. We would indeed be ungrateful if we forgot this fact, but the co-operation and valuable assistance of the Institute by no means stopped there; on the contrary, its branches throughout the province have continued to be one of our main sources of support in co-operating with us in the intensive organization work which we are carrying on throughout the province."

Col. Lamb went on to explain that in March, 1925, the Association, for certain reasons, considered it advisable to withdraw its proposed amendments to the Act, and undertook an intensive organization along the broadest possible lines of the whole engineering profession in this province. He then outlined the work which has been done by the Association towards organization, which has as its prime object the education of the engineer along the lines of working together for the betterment of the profession.

Councillor Ross L. Dobbin, M.E.I.C., introduced the next speaker, Mr. George H. Mickle, formerly head of the Department of Mining Engineering in the University of Toronto, and now with the Department of Mines of Ontario. Mr. Mickle outlined the present status of the mining industry in Ontario. Gold and nickel he placed as most important, and said that both these industries had recovered from very poor business conditions which existed a few years ago.

In introducing Mr. R. B. Wolsey, secretary and registrar of the Association of Professional Engineers of Ontario, Professor H. E. T. Haultain, M.E.I.C., of Toronto, told of Mr. Wolsey's work in connection with the various engineering bodies in Toronto. Mr. Wolsey in a few words, thanked the Peterborough Branch for the invitation to be present at such an enjoyable function.

A. B. Cooper, M.E.I.C., formerly of the Canadian General Electric Company, Peterborough, and now of the Ferranti Electric, Ltd., Toronto, was introduced by W. M. Cruthers, A.M.E.I.C. Mr. Cooper referred to the large number of applications he had been receiving from young Canadian engineers at present located in the United States, who wish to return to this country, and urged that everything possible should be done by the Institute to secure satisfactory positions for these men in Canada.

Replying to Mr. Cooper, Mr. Sheppard stated that similar requests were constantly being received at headquarters, and outlined the efforts which were being made to place such men.

Max Sauer, M.E.I.C., of the William Hamilton Limited, Peterborough, introduced Mr. Arthur Hull, of the Hydro-Electric Power Commission, who, in a few well-chosen words, advised the engineers to study the constitution and by-laws of their associations, and to take an active part in assisting their officers by making constructive suggestions and by supporting them in their work.

George Clark, M.E.I.C., who was introduced by Claude Rogers, M.E.I.C., dealt with the possibilities of the engineer with his technically trained mind occupying executive positions not purely engineering in character. Mr. Clark has recently been appointed manager of the contract department of the Robert Simpson Company.

Mayor Holloway, of Peterborough, spoke in humorous vein, welcoming the visitors to Peterborough and, becoming more serious, referred in terms of praise to the work of the engineer in the advancement of science.

Mr. E. A. Peck, M.P., referred to the lack of engineers in both the federal and provincial parliaments, and urged those present to consider seriously the remarks made by Mr. Sheppard with a view of taking a greater part in national affairs.

Mr. F. H. Dobbin, who was greeted with cheers, spoke encouragingly to the younger men, urging them to do their best in their daily duties and assuring them that their progress was watched and that they would receive recognition for their work.

Illumination

At the regular meeting of the branch, held on December 9th, 1926, the speaker was Mr. H. D. Burnett, formerly manager of several of the lamp factories of the Canadian General Electric Company and now manager of the Lighting Service Department. The chairman for the evening, Paul Manning, A.M.E.I.C., in introducing the speaker, referred to the fact that this is an age of rapid progress, and especially so in the matter of illumination.

Mr. Burnett prefaced his remarks with the statement that as one-quarter of our lives was spent under artificial light and sight is the most valued of the senses, there was ample reason for giving the subject due consideration. Statistics showed that there was a progressive increase in defective vision with age, from 15 per cent in young children, to 50 or 60 per cent in middle age and so on, and the speaker claimed that this was largely due to insufficient or incorrect lighting.

He outlined the requirements of good illumination as being:—ample light on the work and sufficient on the surroundings, freedom from glare, avoidance of heavy shadows, suitable colour of light, convenience for cleaning, and, last and least, reasonable cost.

The modern scientific methods of designing lighting schemes were next described, as opposed to the rule of thumb methods formerly used. The first thing to be decided is the intensity of illumination, and for this purpose standards have been set up by the Illuminating Engineering Society, giving intensities in foot-candles for every conceivable class of work and kind of building.

At this point the speaker defined very clearly the more common terms used in illuminating engineering—candlepower, foot candle, lumen, coefficient of utilization, factor of depreciation, etc.

Emphasizing most strongly the necessity for avoiding glare, Mr. Burnett urged the use of reflectors or globes to hide the lamps, especially those of the gas filled type. This led to consideration of the three general types of luminaries, the direct, semi-direct and wholly indirect, and the characteristics, advantages and disadvantages of each.

Having determined the intensity desired and the most suitable type of unit the speaker showed how, by a knowledge of the output in lumens of different lamps and of utilization factors for different colours of walls and ceilings and sizes of room, the total wattage or the watts per square foot was obtained.

It was then only necessary to decide on the number of units, paying due regard to the fact that, though the larger lamps are more efficient in lumens per watt, enough units must be used to give even illumination and avoid shadows.

Mr. Burnett showed a large number of slides of lighting installations, good and bad, also giving in graphical form the effects of good lighting in better discrimination, reduced fatigue of the eyes, reduction of accidents and increased production. He also, by the use of an ingenious "box of tricks," gave an interesting demonstration of varying effects obtainable by light from different directions, and of the great changes in appearance of coloured fabrics under lights of different colours,—here the "daylight lamp" with bluish glass bulb is most useful.

At the conclusion Mr. Burnett answered a number of questions and was given a hearty vote of thanks, proposed by George Burchill, Jr.E.I.C.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

Thermit in Ice Control

At the first evening lecture of the present season, arranged by the Ottawa Branch, Dr. Howard T. Barnes, D.Sc., F.R.S.C., M.E.I.C., F.R.S., professor of physics at McGill University, was the lecturer. That his subject, "Use of Thermit in Ice Control Work," was of great interest, not only to engineers, but to the general public, was attested by the large crowd which gathered in the Palm Room of the Chateau Laurier on December 9th.

Dr. Barnes first reviewed the history of ice investigations, in which he had been more or less engaged since 1895. Ice, he said, commenced to form when the temperature of water had been lowered a very small fraction of a degree, say a few thousandths below 32 degrees Fahrenheit, and melting commenced at a correspondingly small variation above 32 degrees. A very small change in temperature therefore had a great effect in preventing the formation of ice, and Dr. Barnes at this point paid high tribute to John Murphy, M.E.I.C., of Ottawa, electrical engineer of the Department of Railways and Canals, and of the Railway Commission, whom he termed the first "ice engineer." Away back in 1904, Mr. Murphy had, in spite of the derision of many people, courageously applied the results of physical experiments to the solution of a practical problem. It was generally recognized as being absurd to try to heat a river or other large body of water to prevent ice formation, and yet Mr. Murphy, by the introduction of steam into turbines, prevented the troublesome frazil ice, which had been the cause of great worry to the power-house superintendent, from sticking to the turbines and shutting them down.

The action of the early morning rays of the sun on icebergs furnished another example of the effect of a small amount of heat. The sun's rays at daybreak penetrate to considerable depths and the infinitesimal amount of heat sets up forces which cause the berg to crack. Ice control then, according to the speaker, depended on the proper use of a small amount of heat in such form that it would penetrate to great distances. Thermit, he said, possessed this property, and with slow motion pictures, Dr. Barnes demonstrated the explosives or shattering effect of charges of two pounds of thermit placed in blocks of ice weighing 400 pounds. The thermit used consisted of a mixture of metallic aluminum and iron oxide, which was placed in a metal container in the ice and ignited. The aluminum takes the oxygen from the iron oxide, forming an oxide of aluminum with the generation of 5,000 degrees Fahrenheit of heat. When burning has proceeded to a certain degree, the bottom is melted out of the metal container and the thermit comes in contact with the ice. The iron has an affinity for the oxygen molecules of the ice and great quantities of hydrogen are released. There is a great disruptive force and the experimental blocks were virtually burned up, Dr. Barnes stated. The moving pictures showed the burning column of liberated hydrogen.

The lecturer then proceeded, with the aid of lantern slides and moving pictures, to show the help which he had given with thermit in March of this year to Oil City and Franklin, Pennsylvania, in lowering the flood waters of the Allegheny river, and how, with the coming of warmer weather and rain, the ice jam, which blocked the river for a distance of twenty-five miles, had eventually moved out in orderly fashion without serious damage to property. He stressed the part which thermit had played in clearing a channel under the ice and in saving the Reno traction bridge at Oil City. This bridge had been lifted 18 inches off its piers by the ice. Following thermit treatment, it had settled back into place without damage and was immediately re-opened to traffic.

Dr. Barnes also spoke of the experiments conducted on icebergs off the coasts of Newfoundland last summer. Following treatment with a thermit mine, a large berg had split asunder within a few hours and had turned over. Thermit had also been used effectively in an experimental way on the St. Lawrence river in the spring of 1925. The judicious use of a small amount of thermit at key positions had caused a heaving of the ice and the jams had moved out in each case within twenty-four hours.

At the conclusion of the lecture, Mr. Murphy gracefully returned the compliment which Dr. Barnes had paid him. He had known Dr. Barnes for many years and had followed with great interest the important work which the latter was doing in his ice research work. Mr. Murphy then had a slide thrown on the screen which gave the United States Government record of maximum and minimum temperatures at the nearest point of record on each of the days during which Dr. Barnes had been engaged in the Allegheny river relief work. In friendly fashion he pointed to the rising temperatures and the rain which fell, and wondered whether Dr. Barnes had given sufficient credit to "old sol" and the rain. Dr. Barnes reiterated that he had not been trying to work against nature but with it and had kept close watch for favourable weather. He emphasized the fact that the jam had been loosened from the lower end and had gone out in orderly fashion, the reverse of what would have been expected had nature alone been allowed to take its course.

D. W. McLachlan, M.E.I.C., engineer-in-charge, St. Lawrence Waterways, Department of Railways and Canals, also had a word to say about the thermit experiments on the St. Lawrence river. Referring to the Chimney Island jam, he found that the records of the temperature of the water showed that the jam might be expected to move within twenty-four hours of the time when thermit was used, and in fact he had a report to this effect from one of the officers stationed at the river. Dr. Barnes again pointed out that there were similar results in three cases, which, however, he admitted might have been coincidences.

J. D. Craig, M.E.I.C., chairman of the Ottawa Branch, presided and thanked Dr. Barnes for the delightful entertainment afforded by his most interesting lecture.

Pre-treatment of Fuels

At the luncheon meeting held in the Chateau Laurier on Friday, December 3rd, the Ottawa Branch was particularly favoured in having as its guest and speaker C. H. Lander, D.S., director of the British Fuel Research Board. Dr. Lander attended the International Conference on Bituminous Coal at Pittsburgh, Pa., and came on to Ottawa especially to address the Ottawa Branch.

The subject of Dr. Lander's talk was "The Pre-treatment of Fuels," and the speaker traced the progress made in research since the Fuel Research Board was formed in 1917 for the dual purposes of making "a survey of the fuels of Great Britain from the chemical and physical point of view," and "of investigating problems of pre-treatment to make fuels with greater availability of heat." The fuel research station at Greenwich cost about $1,000,000. The survey had an immediate beneficial result for the operators, since close examination of vertical and horizontal samples from the coal seams disclosed the characteristics of the coal, particularly the sulphur bands. The survey will take many years to complete.

Dealing with the pre-treatment of coal, Dr. Lander said that its object, generally speaking, was to raise the availability of heat units and that this was always accompanied with the loss of some units.

The problem of greatest importance in Great Britain was to get a smokeless fuel, which would better atmospheric conditions in the great cities. On account of there being practically no natural oil and no natural gas in the British Isles, a solution which would yield oil as a by-product would be very attractive.

Three methods of producing coke were mentioned:—The high temperature (1,200°) gas-house process with gas the main object; the metallurgical process; and the low-temperature carbonization (600°) or coke-house process. The coke produced in the gas-house is not popular and neither is the hard metallurgical coke. The low-temperature carbonization yielded a more free-burning fuel which was suited to the English use in open grates, and it produces fuel oil as a by-product.

Dr. Lander said there were many processes for low-temperature carbonization. He personally knew of 200. The mere designing of a system of treatment did not make it a commercial success and the Fuel Research Board had started at the bottom with bench tests of a few grams of coal in test tubes, after which they had entered the second stage with tests of 50 or 100 pounds. The third stage was the development of a unit plan. This stage had been reached and the research station plant was capable of handling eight tons of coal per day on low-temperature carbonization. The remaining stage in the development of low-temperature carbonization was its utilization in industry as a commercial paying proposition and the multiplication of the unit plant into great batteries of coke producers.

The board is also investigating the production of synthetic gasoline, and there is no question, the speaker said, of the feasibility of producing a synthetic gasoline or a product very nearly akin to natural petroleum.

Dr. Lander was optimistic as to the outcome of the experiments being undertaken and implied that the time would come when the utilization in industry of the successful results of low-temperature carbonization would be an accomplished fact.

J. D. Craig, M.E.I.C., chairman of the Ottawa Branch, presided, and expressed the highest appreciation of Dr. Lander's address, which was of very great interest to Canadians on account of the great deposits of bituminous coal in Canada.

Canadian Coal for Canadian Consumers

"Canadian Coal for Canadian Consumers," was the subject of an able and eloquent after-luncheon address by Mr. E. J. Garland, M.P., to the members of the Ottawa Branch at the Chateau Laurier on December 16th.

Mr. Garland, who represents the constituency of Bow river, Alberta, in parliament, has given a great deal of thought to this subject, which is of exceedingly great interest to all Canadian engineers. A national subject of ranking importance with any others before Canadians today, the speaker tackled it along broad economic lines.

"Of what use are natural resources if you do not use them?" asked Mr. Garland. The coal in Alberta alone represented 15 per cent of the world's supply. Of the total reserves of coal in the British Empire 72 per cent is in Alberta, and again, 87 per cent of all Canada's coal is in the same province. But the mere presence of coal did not constitute wealth. A bank would not loan a dollar on it except as a development proposition with a market for the product.

"The coal purchases which Canadians have made in the United States would have paid off the national debt," said Mr. Garland, and $100,000,000 was being expended annually for coal and the transportation of it from fields outside of Canada, an amount equal at least to $300,000,000 in purchasing power, if spent at home, since money, according to the speaker, turns over from three and one-half to five times annually. This would maintain a population of one million people. The turn-over of this money would benefit all classes, not merely miners, for only one-third of the cost of coal goes to the mines. Another third is expended for transportation, and the remaining third for distribution. All provinces of Canada, not merely those with coal mines, would therefore benefit through the mining of Canadian coal.

Mr. Garland stressed the point that $100,000,000 a year of Canadian money is being spent to maintain a non-Canadian industry, and that as the population of Canada increases, unless the problem of using Canadian coal is solved, this export of wealth would increase in proportion. Solution of the problem meant, like the growing of wheat, more new wealth; it meant more miners, more machinery, more transportation tonnage, more clothes, more food, more homes, more railway work, more factory work and greater national purchasing power.

Coming to the solution of the problem of "Canadian Coal for Canadian Consumers," Mr. Garland did not think that the coking of coal presented a solution. It was only commercially feasible, in his opinion, where there was a nearby market for the by-products, especially gas. Such situations existed in the United States, where there were great centralizations of industry with large populations. He had visited the large modern coking plant at Troy, N.Y., and found it operating under ideal conditions for commercial success. This plant cost $6,000,000, and produced 1,000 tons of coke and 18,000,000 cubic feet of gas per day. The company controlled coal mines and had cheap transportation, with its plant located on the Hudson river. Great industrial concentration with large cities and towns nearby furnished a market for its products. In Canada there were few such opportunities, Montreal, Toronto and Hamilton representing the nearest approach to parallel conditions.

Could Canadian mines supply Canada's coal needs in a hurry? Mr. Garland found that they could, at least insofar as domestic and steam requirements were concerned. Canadians consumed at present 33,000,000 tons annually, of which 18,000,000 tons are imported. But the capacity of the existing mines is double the present output and with very little additional overhead the demand could be met.

The solution, Mr. Garland found, lay in cheaper transportation. At present the market for British Columbia's coal was limited to the Pacific coast, while the Maritimes were confronted with high rail rates, which, if satisfactorily adjusted, would permit of eastern coal moving further into central Canada. The freight rate on Alberta coal to Toronto is $12.50 per ton, though a limited amount had been brought down under a special concession at $9.00 per ton. The cost of bringing Alberta coal to Ontario, the speaker said, had been grossly over-estimated, and he went into details of costs presented by the Canadian National Railways to show this. After paring down items, which he found ridiculously high, he arrived at an out-of-pocket cost of $5.25 per ton. If the Railway Commission found the cost not to exceed $7.00 per ton, he thought the problem was solved.

There was no need of bounties or subsidies. Rates had, in the past, been set to the level at which a commodity would move. This was the governing factor and he believed an out-of-pocket cost rate was justified and would in time yield a profit.

Alberta coal, the speaker said, is practically ashless and smokeless. For domestic use no sifting is required. It can be easily and satisfactorily managed. Mere B.t.u. content is not a measure of the value of a coal to the householder. It is what you can get out of it, said Mr. Garland, and Alberta coal is just as satisfactory as anthracite. He had yet to learn of any criticism of it which would hold good. He appealed to the members of the Institute as Canadians to get behind the movement for "Canadian Coal for Canadian Consumers," and said it was an opportunity for everyone to serve his country. He thought every branch of the Institute should take up the matter and the committee formed in Alberta to further this project would, he knew, gladly send speakers.

J. D. Craig, M.E.I.C., chairman of the Ottawa Branch, presided and thanked the speaker for his interesting address.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

One of the preliminary steps in bridge construction is to plot a curve of traffic expectation. This curve for the Niagara Peace bridge was more than likely revised on or about December 1st to a considerably steeper angle. As a commercial proposition, this revision will probably put it in Class A-1.

Mr. Lupfer, however, tells us that it is not a commercial proposition and upon the paying off and retirement of two bond issues the bridge is to become the property of the adjoining countries and all stock is to be cancelled.

The Niagara Branch had the honour of inspecting this Peace bridge on October 4th; meeting some engineering confreres from Buffalo, and afterwards being addressed by Chief Engineer Edward P. Lupfer at a dinner meeting. The weather was inclement; an east wind with snow made travelling anything but pleasant and thinned the ranks of those who went out on the bridge and had their picture taken for the Buffalo papers, but the dinner at Niagara falls was well attended.

The bridge spans the Niagara river between Buffalo and Fort Erie. It consists of five deck steel arch spans and a through truss span over the entrance to the Erie canal. The arches vary in length from 346 feet to 423 feet and the total length, including approaches, is 5,800 feet.

Remarkably quick time was made by contractors J. P. and R. B. Porter, who had the substructure, the west approach and the concrete decking, and also by the Bethlehem Steel Company, which had the steel superstructure. A little more than fifteen months since the actual construction started and now this $4,500,000 bridge is practically complete. Mr. James Kelly, who was in charge of the steel erection, also received great praise.

Mr. Lupfer, however, did not dwell very strongly upon constructional problems. He spoke of the approaches or terminals and stressed the fact that in these days of rapid transportation they controlled the whole situation, particularly where an international boundary is crossed and examination by the customs and immigration authorities is necessary. The terminals of this bridge are in the shape of a fan, allowing seven lanes of entrance at each end, eleven lanes of exit on the Canadian shore and nine on the American. It is calculated that this arrangement will allow a peak of 3,000 automobiles an hour to be handled in one direction.

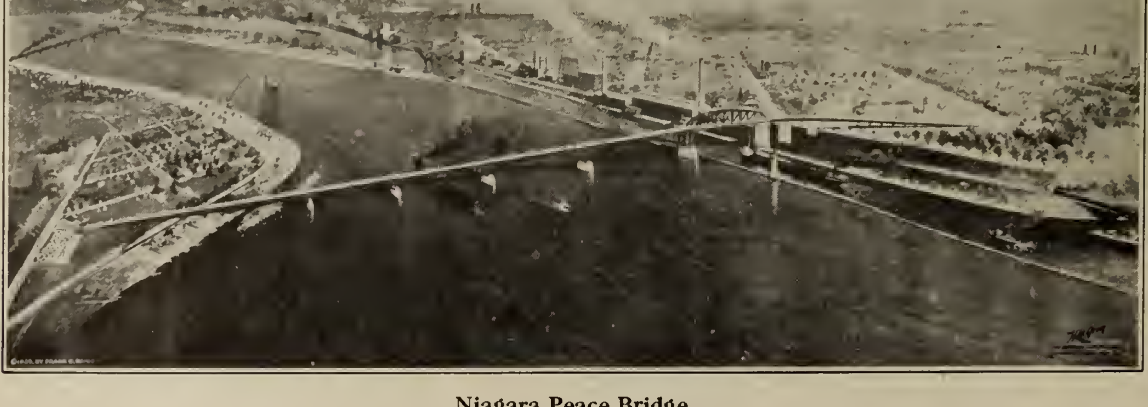
As an indication of what might be expected in the way of traffic, Mr. Lupfer quoted the following figures from the present ferry reports:

	1919	1920	1921	1922	1923	1924	1925
Autos—	134,000	156,000	209,000	293,000	354,000	475,000	550,000
Passengers—	......		1,110,000	......	......	......	3,600,000

The bridge is to be an emblem of peace; of the goodwill which has existed between Canada and the United States ever since the treaty of Ghent in 1814. As Mr. Lupfer expressed it, "The spiritual side of this project cannot be overemphasized. The bridge is designed to be a monument to the method of settling disputed questions by means of arbitration rather than by war."

A tactful compliment was paid to the Victoria Parks Commission by Mr. Lupfer when he referred to the great beauty of the driveway and parks along the Canadian side of the river.

S. R. Frost, A.M.E.I.C., was in the chair. Colonel J. MacDonald moved a vote of thanks and this was seconded by J. R. Bond, A.M.E.I.C., and heartily approved by the meeting.



Niagara Peace Bridge.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

Architectural Design of Buildings

A meeting of the St. John Branch, at which A. R. Crookshank, M.E.I.C., presided, was addressed by W. W. Alward, A.R.I.B.A., of Alward and Gillies, architects, St. John, on November 18th, 1926. The subject of the address was "The Architectural Design of Buildings."

The first section of the address dealt with an historical sketch of the different forms of ancient architecture. The first known forms of architecture existed in the early tombs on the banks of the Nile, and were followed by the Chaldean types. Architecture received greatest attention and made its greatest progress during the early Greek civilization. The various features of the Parthenon of Athens were described as an example of the splendid style of architecture developed by the Greeks. It was shown that the Greeks were familiar with tricks to overcome the effects of optical illusions so that the completed structure was not only structurally sound but also pleasing to the eye. The speaker also mentioned the Graeco-Roman type of architecture prevailing in Great Britain at the beginning of the last century, and the mid-Victorian type of fifty years ago.

The present types of industrial buildings were touched on, and it was shown that a plain office building with every detail properly proportioned to bear its share of load, was architecturally correct on account of its simplicity of outline.

Various forms of architecture on different buildings in St. John were mentioned. The point was brought out that some good examples of architecture exist on buildings in this city.

By using a blackboard the speaker showed how architectural drawings were made. In particular, the method of making perspective drawings was shown at some length. Following a discussion on the address, a vote of thanks to the speaker was moved by G. N. Hatfield, A.M.E.I.C., and J. D. Garey, A.M.E.I.C.

Industrial Lighting

On December 9th, 1926, the members of the St. John Branch were addressed by S. C. Webb, A.M.E.I.C., on the subject "Industrial Lighting." The meeting was held in the New Brunswick Telephone Company building, with A. R. Crookshank, M.E.I.C., presiding.

The crude early forms of lighting were briefly mentioned,—the fire brands thrown into the caves in early days, torches, oil-lamps, and finally to the incandescent electric lamp developed by Edison in the latter part of the nineteenth century. The carbonized filament of Edison's lamp was later replaced by the tungsten filament lamp of the present day. The application of the "Lumen" method was described in arriving at sizes and numbers of electric lights to use in lighting given areas under certain conditions. Such details as the style of reflector, location of the fixture, and the later necessary maintenance by removal of dust and dirt from electric globe were stressed.

The speaker showed by demonstrations of several classes of lights and fixtures, specially installed in the room for this meeting, the different lighting effects obtained. A moving picture reel entitled "Yesterday and Today," contrasted the difference between electricity and other forms of lighting. Two reels were shown of the manufacturing processes of an electric light bulb. A vote of thanks to the speaker was moved by Geoffrey Stead, M.E.I.C., and G. N. Hatfield, A.M.E.I.C.

A moving picture describing the electrical developments of the Shawinigan Water and Power Company was shown. A vote of thanks to Fraser S. Keith, M.E.I.C., for courtesy in sending this film was passed by the meeting.

A resolution of regret at the death of E. T. P. Shewen, M.E.I.C., which occurred the afternoon of the day of the meeting, was passed by the branch.

Saskatchewan Branch

R. W. E. Loucks, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held in the Kitchener hotel on November 19th, preceded by a banquet. Vice-chairman M. B. Weekes, M.E.I.C., presided. Guests included Mayor Taisey and Alderman Mathison of Estevan, Sask., both of whom are well known to the members of this branch by reason of their participation in the two summer meetings which this branch has held at Estevan. H. S. Bare, A.M.E.I.C., and S. Wright, of the engineering staff of the new Canadian Pacific Railway hotel under construction in Regina, were also guests at this meeting.

Recent Advance in the Engineering Side of Building Construction

J. H. Puntin's, A.M.E.I.C., paper on "Recent Advances in the Engineering Side of Building Construction," was well received. Mr. Puntin laid particular stress on the feasibility and advisability of winter construction in Canada, or, what may be termed "all year" construction. The extra direct cost of construction in winter over similar work in summer does not amount to more than from 1 to 3 per cent, and this extra direct cost is more than compensated for in other ways. There is a saving in transportation charges, labour, overhead, etc. Authorities all over the continent are agreed that winter construction is the solution of many of the problems of the builder and contractor. Mr. Puntin pointed out that concrete can be poured in the coldest of weather without reducing its strength if the materials are heated before mixing and the concrete when poured is not subject to alternate thawing and freezing.

H. S. Bare, A.M.E.I.C., engineer with the Canadian Pacific Railway hotel, Regina, stated that he has just completed three years of continuous winter construction of concrete and his experience has been that the concrete is not injured in the least with the exposure to frost. His practice is to add four pounds of calcium chloride to each bag of cement, which gives the concrete a seven days' set in twenty-four hours. Salamanders are used to keep the concrete warm until it has attained its initial set. Mr. Bare has recently been engaged on the construction of the Canadian Pacific Railway hotels at Quebec, Lake Louise and Banff. He mentioned the advantages of the Massillon bar joists in floor construction, which is the type used in the Regina hotel.

Mineral Deposits of Southern Saskatchewan

Mr. W. H. Hastings, engineer with the Bureau of Labour and Industries, read a paper on "Mineral Deposits of Southern Saskatchewan, Their Location, Uses and the Possibilities for Development." Mr. Hastings stressed in particular the coal and clay deposits. He also made reference to the deposits of sodium sulphate, volcanic ash and bentonite. He pointed out that Saskatchewan now consumes about 1,500,000 tons of coal annually and mines about 500,000 tons of lignite coal. He predicted that some day Saskatchewan's clays will be as noted as are her agricultural products.

The discussion on Mr. Hastings' paper brought out the possibilities of using the sulphate deposits as a preservative for timber. Messrs. Perry, Lewis and Campbell testified to the fact that railway piles and ties laid in areas covered by sulphates have a considerably extended life over similar timbers laid in ordinary soil.

Mr. Hastings' paper was illustrated by several slides showing the extent and development of the mineral deposits of Saskatchewan.

Outdoor Signs

Stewart Young, A.M.E.I.C., director of town planning with the government of Saskatchewan, read a paper on "Outdoor Signs." Mr. Young described the practice of erecting objectionable bill-board signs on streets and public highways, and the movement towards reduction or elimination or regulation of such signs. Mr. Young's paper was illustrated with a number of suitable slides.

H. S. Carpenter, M.E.I.C., in discussing Mr. Young's paper, spoke of the decision of the Department of Highways to erect traffic signs on all provincial highways, and this will necessitate the removal of many unsightly signs at present located in objectionable locations. He suggested that the erection of "danger signs" may be overdone and lose much of their intended purpose. R. N. Blackburn, M.E.I.C., was of the opinion that signs on private property could not be prohibited. H. R. Mackenzie, A.M.E.I.C., stated that in Ontario the provincial government control and charge fees for the erection of signs on or adjacent to provincial highways.

A vote of thanks to the speakers and pleasure at having such distinguished guests present at the meeting was moved by A. C. Garner, M.E.I.C., and seconded by H. R. Mackenzie, A.M.E.I.C.

Round the World

The meeting on December 10th, 1926, took the form of a "Round the World" night, and consisted of addresses on the outstanding engineering achievements of several selected countries with special reference to the influence of such engineering achievements on world progress.

"Africa" was described by J. C. Meade, A.M.E.I.C., who spent some three years on railway construction in Nigeria. He described the Ju Ju's, consisting of egg shells fastened to sticks stuck in the ground, which the natives regarded as sacred and would not touch. Railway construction is done by hand labour and the materials transported in baskets carried on the heads of the natives. When wheel barrows were supplied the natives carried the loaded wheel barrows on their heads, so the barrows were discarded as being unnecessary. A 3½-foot gauge was used, and sharp curves introduced to reduce the cost of construction. It was necessary to use steel ties, as insects destroy wooden ties very quickly. A number of slides were shown illustrating the remarks of the speaker.

"China" was dealt with by J. G. Schaeffer, S.E.I.C. The Chinese were the earliest of races to use science. As far back as 2900 B.C., we find records of arch design. Gunpowder was used by them long before its use by any other race. One of the earliest and greatest achievements was the building of the great wall, started in the third century B.C. The total length of the wall is about 1,500 miles. It varies in height from 20 to 30 feet. The thickness at the base is from 15 to 25 feet, while the top width is 12 feet. For the most part it was built of round boulders and earth. Masonry construction was used only in the valleys and mountain passes. Another engineering project commenced about 486 B.C. was the construction of the grand canal, portions of which are still being used today. This canal extends from Hang Chow in the south to Peking in the north, a total distance of 1,200 miles. Railway construction, commenced in China in 1875, has gradually increased until in 1923 they had a total mileage of 7,513. China is rich in coal, iron, copper and tin, but owing to lack of capital these mineral deposits have not been extensively developed.

"Germany" was described by P. R. Genders, A.M.E.I.C. He traced the history of the German Empire, and referred to the great advances made in modern industries in that country.

"India," D. D. Low, Jr.E.I.C., described as being divided into three distinct regions, the northern or mountainous region, the central or great plains region and the southern or plateau region. One of the most important engineering achievements of India has been the construction of the great system of canals for irrigation purposes in the Punjab river basin. This has been the means of turning great swamp areas into productive territory. With over 32,000 miles of railway in operation in 1910 the great cities of Calcutta and Bombay had flourished. Bombay is now one of the largest manufacturing centres in the world and derives its energy from the hydro-electric development in the hills of southern India. At one point electricity is developed from a water power with a head of 1,725 feet.

"Italy" was described by G. G. Fitzgerald, A.M.E.I.C., and he confined his remarks mainly to the "Roman roads." Great roads were undoubtedly built long before the beginning of authentic history leading to the pyramids of Egypt and in the vicinity of Babylon. The Persians, Assyrians, Carthaginians, Chinese and Peruvians were all great road builders, but the Romans were the first road builders of whom we have definite knowledge.

The Appian Way and the Flaminian Way were great military highways leading from Rome, and in the height of her glory Rome had twenty-nine great roads radiating from her gates leading to all parts of the great empire. The entire system of main or military roads at that time is estimated to have amounted to 50,000 miles.

The construction of the main Roman roads was extremely massive, consisting of four courses having a total thickness of about three feet and generally a width of from sixteen to thirty-two feet and slightly crowned to permit of drainage. The road was constructed upon a solid foundation of rock or piles and the four courses laid in order as follows:—

1. The foundation course, (statumen), which was composed of large flat stones, bedded in mortar.
2. The rudus, a layer nine inches thick of hand rock, laid in a form of lime or cement mortar.
3. The nucleus, six inches thick, consisting of small stones, gravel, or pieces of broken brick and tile, also laid in mortar or cement, and the top made smooth.
4. The summa crusta, or wearing surface, of large flat blocks of the hardest stone to be found, closely fitted to each other, with the greatest nicety, so as to present a perfectly smooth surface.

The Roman roads usually were located in a direct line from point to point, avoiding deviations which would have reduced the cost of construction materially. That they were substantial is evidenced by the fact that some of them have borne the traffic of 2,000 years without material injury.

The majority of these great highways were built by contract at the public expense. A few were built from the spoils of war, the private wealth of emperors or great personages ambitious for public approval. They were maintained by the enforced labour of soldiers and slaves. The highway legislation of the Romans forms the basis of many of our present road laws. By the Roman law, the right to the use of the roads was inherent in the public.

"Japan" was described by J. B. Parker, A.M.E.I.C., who dealt with the great engineering feat of restoring the telephonic and telegraphic communication in Tokio following the recent earthquake and fire in that country on September 1st, 1923.

The earthquake disrupted and broke all telegraph circuits radiating from Tokio, including cables, etc., and many of the central offices were burned. However, a temporary telegraph office was opened in the Tokio central post office and on the second day,—thirty-five hours after the earthquake,—communication regarding relief business was successfully opened to three neighbouring cities. By repairing underground cables, communication was re-established in eight days to six adjacent cities and a circuit established between the central telegraph office and the telegraph corps radio station in one of Tokio's suburbs, which acted as a link for other radio stations and the warships in the harbour. Sixteen faults were located in the Guam cable to the United States, and these were repaired by October 27th, under great difficulties owing to the depth of the water. Of the twenty telephone exchanges fifteen were burned, one was unavailable and only four capable of renewing business. Sixty per cent of the subscribers' stations were burned and practically half the outside plant was destroyed. By November 10th sufficient circuits were opened so that all restrictions were removed.

"Norway and Sweden" were covered by Edwin Markham, A.M.E.I.C. The outstanding engineering achievement of the Norwegians is the development of water power. There are in Norway twelve million horsepower of electrical energy under development or consideration. About 75 per cent of the population are already supplied with electrical energy. The cost to the consumer varies from $25 to $65 per kilowatt per annum. Of the power developed in Norway, 42 per cent is used in electro-chemical and electro-metallurgical industries. Included in the twelve million horsepower is provision for the electrification of the railways of that country.

Sweden has available six million horsepower of electrical energy and only about 50 per cent of this can be economically developed. In that country electricity is used extensively to operate farm machinery.

Bessemer's process in making steel was introduced into Sweden in 1858 and at that time it was almost essential to use the Swedish iron ore being low in silicon content.

"Russia," according to W. T. E. Smith, BRANCH AFFILIATE, owes her chief claim to greatness to her agricultural resources. Her steppes have raised more grain in a single year than any other country. In 1913 this amounted to 1,027,000,000 bushels.

Industrially, Russia is very weak, most of her wealth is in raw products and her trade consists largely of exporting this instead of manufacturing it at home. One very vital need of Russia is the railroad. Even in 1913 a much greater proportion of her freight traffic was carried on her rivers than on her railroads. In 1860 she had less than 1,000 miles of railway and in 1905 about 40,500 miles.

Since the war there has been a slowing up of many of the industries of Russia and this situation is due to the lack of foreign capital for investment in that country.

At the conclusion of these addresses a ballot was taken for the purpose of selecting the best and the one most nearly conforming to the instructions governing their preparation. The vote was in favour of Mr. Fitzgerald's address on Italy, and he was presented with a suitable gift.

Amongst the visitors was F. K. Beach, A.M.E.I.C., from Calgary. He conveyed the greetings of the Calgary Branch, of which he is a prominent member.

A vote of thanks to the speakers was moved by A. P. Linton, A.M.E.I.C., and seconded by S. Young, A.M.E.I.C.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting was held in the Y.W.C.A., Queen street east, on November 26th. A dinner for the members and guests was held previous to the meeting.

Chairman C. H. Speer, M.E.I.C., called the meeting to order and disposed of the business. Mr. Speer then briefly gave a report of the Great Lakes Harbour Commission convention held at Buffalo on November 15th and 16th. This meeting was one of protest against the existing conditions at Chicago in regards to the Chicago drainage canal and the taking of 10,000 feet of water from lake Michigan. Mr. Speer was one of the delegates representing Sault Ste. Marie, Ontario, at the convention.

Mr. H. B. Greenstead, engineer of tests of the Algoma Steel Corporation, was introduced by the chairman and gave a most interesting paper on "The Manufacture and Composition of Alloy Steel."

A hearty vote of thanks was tendered to Mr. Greenstead by Messrs. A. E. Pickering, M.E.I.C., and W. J. Fuller, M.E.I.C.

Toronto Branch

J. W. Falkner, A.M.E.I.C., Secretary-Treasurer.
J. Hyslop, M.E.I.C., Branch News Editor.

Construction and Maintenance of Equipment on a Modern Electric Railway

On November 25th, Mr. W. R. McRae, superintendent of rolling stock, Toronto Transportation Commission, read a paper on "Construction and Maintenance of Equipment on a Modern Electric Railway."

When the Toronto Transportation Commission took over the Toronto Street Railway system a thorough analysis determined that complete modernization of rolling stock and shops was necessary for economical operation; the results have shown the wisdom of this decision.

All new cars purchased were of the Witt type of steel construction with wood interior trim; the motor cars having front entrance and centre exit and the trailers with centre entrance and exit. All cars retained from the Toronto Railway system were rebuilt; part to front-entrance rear exit types; part to one-man operated with front entrance and front and rear exit, and part for two-car train operation, the front car being fitted with motors on all axles and the rear car with motors on two front axles only. All car heaters are of Peter Smith type coal fired, the ventilation is well cared for, the air being changed every three minutes.

The one-man operated cars have been used on certain routes, proving economical in operation, the cost of conversion being absorbed by eleven months' operating economies.

The commission's repair shops are entirely new, of fire-proof construction, occupying an area of 10.4 acres. They are the result of very careful study, containing the following sections: car body erection, machine shop, wood working shop, blacksmith shop, motor shop, paint shop, and stores. All tools are modern. Car movement inside the shop is handled by an electrically operated transfer table and the handling of car parts by means of an overhead electric monorail system.

One specially interesting piece of equipment is the car straightening equipment, whereby cars distorted in collision are straightened. This work is done in most cases without the necessity of dismantling the parts affected.

Painting is done by the spray method, which proves economical both in time and paint, striping and lettering being done by hand.

All cars are given a general overhaul every 60,000 miles. Its various parts are removed or overhauled, repaired and tested trucks are fitted to body, which has all dents removed, and is then scrubbed, dried and sent to paint room. After being painted the car and equipment is thoroughly tested; the car being in the shop for a period of six days.

Story of Compressed Air

On November 25th, Mr. G. R. Southee, of Canadian Ingersoll Rand Company Limited, addressed the members of the branch on the "Story of Compressed Air."

Mr. Southee's paper was well illustrated by moving pictures. After showing the principle of the air compression, the moving pictures showed its application to various fields, including mining, quarrying, stone cutting, moulding in foundries, riveting, chipping in iron work, wood working, hoisting, water lifts, hat and sausage manufacture. After the paper an animated discussion took place.

Victoria Branch

K. M. Chadwick, M.E.I.C., Secretary-Treasurer.

A business meeting was held on November 3rd, with J. N. Anderson, A.M.E.I.C., branch chairman, presiding.

A vote of sympathy was passed to J. Hunter, M.E.I.C., who was injured in an unfortunate motor accident recently.

Nominations for the 1926-27 executive were made and other branch business attended to.

On the completion of business the chairman called on Major J. C. MacDonald, comptroller of water rights, for his paper on "The Okanagan and Its Problems." An abstract of this paper appears in this issue of the Journal.

The chairman expressed the thanks of the meeting for this interesting paper, and after Major MacDonald had answered a number of questions in regard to markets, orchards and irrigation, the meeting adjourned.

On November 16th Major Geo. Walkem, M.E.I.C., president of the Institute, and also of the British Columbia Association of Professional Engineers, was a guest at a joint luncheon of Victoria members of the two societies, some thirty-three sitting down to lunch.

The branch chairman, J. N. Anderson, A.M.E.I.C., in calling on Major Walkem to speak, remarked that the West was rarely honoured with the selection of the president of the Institute, and that besides his dual presidential office Major Walkem was also member in the provincial legislature for Richmond-Point Grey.

The president gave a rapid sketch of the progress of many of the branches he had visited from the east to the west of the Dominion, outlining the industrial, or educational, or governmental conditions at each centre that made the continuance of a branch possible at that place.

While the address, unfortunately, does not lend itself to detailed report, it was of great interest to members of the Institute, and afforded a large amount of information on industrial progress in many parts of the Dominion, particularly in the east.

The thanks of those present for the favour of a visit were suitably expressed by the chairman.

Listening to such an interesting recital of the difficulties, successes and progress of other branches, gave a realization of the unity of the Institute throughout Canada, encouragement for the future, and suggested that this contribution of Branch News was an opportune one in which to say:—

Best wishes to all for an enjoyable and prosperous New Year from Members of the Victoria Branch.

Annual Meeting

The annual meeting of the branch was held on December 1st, and after the election of the officers for the coming year, F. C. Green, M.E.I.C., gave a lecture on "Some Experiences of a Surveyor."

Under British Columbia law the same piece of land might be subject to the following leases and rights, (1) timber lease, (2) apex mineral rights under the 1891 Act, (3) ordinary mineral rights, (4) placer rights, (5) coal lease, and (6) a pre-emption. All these might conceivably occupy the same area, all with well defined rights and all yielding revenue to the government.

The speaker proceeded to describe incidents from his own experience. The most striking was a case where during railway construction a fire did extensive damage to logging operations and standing timber in the Fernie district. A suit for damages was tried at Nelson and as a hopeless conflict of evidence developed, the trial was adjourned to the ground, and the judge, jury, sheriff, witnesses and council travelled two hundred miles to Fernie, where the trial was carried on amid the old stumps of timber. The judgment as finally given probably differed widely from what it would have been had it been based solely on the evidence given at Nelson. This precedent if followed might aid justice in other engineering disputes.

Travel on the Cariboo road, in stage coach days, and the hundred-mile snowshoe trip over the trail to Fort George, a distance now covered by a good motor road, were next described. It then took five or six days to travel what can now be done in the same number of hours by motor. The speaker closed with some anecdotes of the trail and a reference to an axe-made cantilever bridge for streams where the timber is too small to span.

Winnipeg Branch

James Quail, A.M.E.I.C., Secretary-Treasurer.

Meeting of October 21st

The meeting of the branch, held on October 21st, took place in the plant of the Canada Malting Company, Winnipeg. It convened in the laboratory with thirty members and visitors present. The chairman, N. M. Hall, M.E.I.C., occupied the chair. He introduced Mr. Geo. Bailey, manager, who addressed the meeting, describing the processes of malting, and the various uses of malt, with details of the market for it,—as a preliminary to conducting those present through the plant.

The meeting was divided into two parties, one of which was conducted through the plant by Mr. Bailey, and the other by Mr. K. E. Grant. The vote of thanks was moved by E. P. Fetherstonhaugh, M.E.I.C., who expressed regret that the weather and a conflict with other meetings should have conspired to make the attendance at an unordinary and most enjoyable meeting smaller than it would otherwise have been.

Meeting of November 4th

The meeting of the branch of November 4th was held regularly. N. M. Hall, M.E.I.C., chairman, occupied the chair. There were some eighty members and visitors present.

Under "new business" the chairman reported the proposed meeting of the Empire Mining and Metallurgical Congress, which would convene in Canada in August, 1927. Preliminary steps in the arrangements for the congress, insofar as Winnipeg Branch would co-operate in them, were left in the hands of the executive.

The attention of the meeting was drawn to the provincial Public Utility Board Act. In this connection the secretary was instructed to communicate with the provincial government to the effect that, in the opinion of the branch, a member of it as a member of the board, would be advantageous in the administration of the act.

Dr. J. W. Shipley and C. F. Goodeve were the speakers of the evening. The subject was "The Formation of Explosive Gases in Electrically Operated Steam and Hot Water Boilers." In introduction Dr. Shipley said that the subject would be presented in the form of a paper that would cover the consideration of the effect of the gases formed, the nature of electrode materials, and the variation in current densities; and that suggestions would be made as to the direction which investigation should take to find solutions for the problems involved. A demonstration with the apparatus used in the research would be attempted.

Dr. Shipley gave Mr. Goodeve credit for the development of experiments into important research.

Mr. Goodeve outlined the history of the investigation of the subject. He followed that by presenting in detail theoretical and practical analyses of the reactions taking place.

E. V. Caton, M.E.I.C., moved the vote of thanks.

Kamloops Area Mapped

An area of about 400 square miles in the interior plateau of British Columbia, in the vicinity of Kamloops, is shown upon a new map sheet just issued by the Topographical Survey, Department of the Interior. The sheet is known as the Kamloops sheet of the National Topographic series. It is issued on the scale of one mile to the inch, and was compiled from surveys by the above named organization during the past two years, together with information supplied by the Surveys Branch, Department of Lands, British Columbia, and by the Geological Survey of Canada.

Recent Additions to the Library

Proceedings, Transactions, Etc.

PRESENTED BY THE SOCIETIES:

American Society for Testing Materials; Tentative Standards 1926; Standards Adopted in 1926; Yearbook, August, 1926.
Institution of Civil Engineers; Minutes and Proceedings, vol. 221, 1925-26; Selected Engineering Papers, Nos. 33-42.
National Electric Light Association; Transactions, vol. 83, 1926.

Reports, Etc.

PRESENTED BY THE GOVERNOR OF THE PANAMA CANAL:
Annual Report, 1926.

PRESENTED BY THE CITY MANAGER OF SHAWINIGAN FALLS:
Report, 1925.

Technical Books

PRESENTED BY THE SCIENTIFIC BOOK CO.:
McCullough, E., Practical Structural Design, 1926.

PRESENTED BY SOCIETY OF AUTOMOTIVE ENGINEERS:
Handbook, September, 1926.

PRESENTED BY THOMAS NELSON AND SONS:
Nelson's Perpetual Loose-leaf Encyclopædia. Index volume, 1926.

PRESENTED BY THE SOCIETY OF MOTOR MANUFACTURERS & TRADERS, LTD.:
The Motor Industry in Great Britain, 1926.

PRESENTED BY COL. WORTHINGTON:
Cresy, Edward. Encyclopædia of Civil Engineering, 1847.
Dempsey, G. D. Practical Railway Engineering, 1847.
Gwilt, Joseph. Encyclopædia of Architecture, 1851.
Haupt, Herman. General Theory of Bridge Construction, 1851.
Mahan, D. H. Elementary Course of Civil Engineering, 1854.
Mahan, D. H. Industrial Drawing, 1852.
Wyld, Samuel. The Practical Surveyer, 1780.

PRESENTED BY C. R. YOUNG AND W. B. DUNBAR:
Net Sections of Drilled Plates, 1926, (Univ. of Toronto, Bull. 6).

PRESENTED BY LIBRAIRE PAYOT & CO.:
Major, Benjamin. Introduction à la statique graphique des systemes de l'espace.

Railway and Hotel Arrangements for Annual Meeting

In connection with the forthcoming Annual Meeting to be held in Quebec on February 15th, 16th and 17th, please note that round trip tickets will be issued to groups or parties by both the Canadian National and the Canadian Pacific Railways on the following basis:—

Number of party—not less than *ten* adults.

Going	—must all travel together on the same train and from the same station.
Returning	—may travel individually if desired.
Rate	—Fare and one-half for the round trip from the Branch headquarters City to Quebec and return.
Time limit	—Points East of Fort William—ten days—(From Western Canada a longer limit is given).

If you propose attending the meeting in Quebec, please communicate *at once* with your Branch Secretary so that a party may be organized, and that as soon as he has received the necessary number of names he may arrange for the group rate with the local Passenger Agent of the railway selected.

If a sufficient number offer, a through car can be arranged for from the concentration point to Quebec.

Members are reminded that they must make their own hotel reservations at Quebec, and, owing to the popularity of that city as a winter sports centre, early action is needed to avoid disappointment.

The following special rates have been arranged at the Chateau Frontenac:—

Single room without bath	$3.00
Single room with bath	4.00
Double room with bath	7.00

Engineering Institute of Canada Headquarters and Registration Bureau will be at the Chateau Frontenac.

Preliminary Notice

of Applications for Admission and for Transfer

December 18th, 1926

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in January, 1927.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ANNETT—FRED. A., of Flushing, N.Y., Born at Lakeville, N.B., Aug. 26th, 1879; Educ., mech. elect'l engrg course, Am. School of Correspondence; grad. from N. Y. Elect'l School, 1906; 1906-09, instructor, elect'l machinery, N. Y. Elect'l School; 1909-12, elect'l engr., Mtce. Co., N. Y. C.; 1912-16, ch. instructor, N. Y. Elect'l School; 1916-18, "Power" editorial staff; 1918-19, 1st lieut. U. S. Ordnance Dept.; 1919 to date, "Power" editorial staff.

References: S. Svenningson, N. R. Gibson, J. Murphy, T. H. Hogg, H. G. Welsford, H. B. Oatley, C. L. Havens.

BONAVENTURE—JOSEPH EUGENE, of Three Rivers, Que., Born at Lanoraie, Que., Sept. 12th, 1890; Educ., B.A.Sc. Civ. Eng., Ecole Polytechnique, 1914; 1914 to date, asst. dist engr., Dept. of Public Works of Canada, i/c surveys, explorations, preparation of contract plans, specifications, inspections dredging work, estimates supervised and designed regulation works, etc.

References: A. R. Decary, B. GrandMont, Ellwood Wilson, J. H. Valiquette, C. L. Arcand.

BURWASH—LACHLIN TAYLOR, of Ottawa, Ont., Born at Cobourg, Ont., Sept. 5th, 1874; Educ., M.E., Univ. of Toronto, 1912; 1899-1912, mining inspector, Dom. Gov't.; 1915-19, military service overseas; 1921-26, exploration, Arctic; at present, exploratory engr., N. W. Territories and Yukon Br., Dept. of Int.

References: O. S. Finnie, J. D. Craig, G. H. Blanchet, F. C. C. Lynch, T. H. G. Clunn.

CROPPER—WILLIAM CHARLES McDONALD, of Montreal, Que., Born at Kingston, B.W.I., May 2nd, 1884; Educ., B.Sc., McGill Univ., 1905; 1905 to present time, with Northern Electric Co. as dftsman; 1905-06, telephone apparatus and equipment engrg.; 1906-09, fire alarm and police signal systems engrg; 1908-09, general mech. and elect'l engrg.; 1909-15, engrg. of city layouts, and design and adaptation of F.A. and P.S.S. apparatus, also general mech. and elect. engrg.; 1911 to present, apparatus engr.

References: W. C. Adams, P. F. Sise, J. D. Hathaway, W. S. Vipond, R. W. Boyle, H. M. Macquays, J. S. Cameron.

FREELAND—JOHN JAMES, of Montreal, Que., Born at Montreal, Que., Oct. 21st, 1891; Educ., B.Sc., McGill Univ., 1915; Jan to Oct. 1919, Pipawa Co. Ltd., dfting and instrument work on pulp mill constrn.; 1919-20, dfting on pulp mill mtce., Fraser Companies Ltd., Edmundston, N.B.; 1920-23, with R. B. Wolf Co., New York, and Newton Falls Paper Co., reconstruction and mtce. work, dftsman and ch. dftsman; 1923-24, Can. Vickers Ltd., asst. to res. engr. on structural steel erection; 1925, Dom. Bridge Co., drawing shop details St. Maurice Valley Corp., Shawinigan Falls, Que.; also constrn. drawings on paper mill extension; since Aug. 1926, constrn. dftsman on paper mill work, Mistassini Power & Paper Co. Ltd., Montreal.

References: J. Stadler, S. J. Fisher, G. Claxton, A. R. Sprenger, H. H. Hawkes, A. D. Porcheron, C. M. Bang.

GIBBON—HUBERT STUART VROOM, of St. John, N.B., Born at St. John, N.B., May 21st, 1904; two yrs. engrg course at Mt. Allison Univ., one yr. McGill; one summer, Geodetic Survey of Can. as recorder; 8 mos. cost acct. on constrn.; one yr. dftsman and estimator in gen. contractor's office; constrn. engr. with Foundation Co. of Can.; at present, engr. with Quebec Devel. Co., Isle Maligne, Que.

References: C. B. Bate, N. K. Cameron, H. W. McKiel, F. L. West.

HASTINGS—WALTER HINDSON, of Regina, Sask., Born at Watford, Ont., Feb. 27th, 1894; Educ., B.Sc., McGill Univ., 1922; 1923 to present time, engineer to the Bureau of Labour and Industries, Sask. Government, i/c natural resources division.

References: H. S. Carpenter, A. P. Linton, H. R. Mackenzie, M. B. Weekes, D. A. R. McConnel, J. M. Patton.

JOHNSTON—THOMAS, of Detroit, Mich., Born at Glasgow, Scotland, Dec. 29th, 1896; Educ., Hulme Grammar School, Manchester, Eng., 3 yrs. night school, Manchester College of Tech.; 1913-20, Redpath Brown & Co. Ltd., with exception of 4½ yrs. at War; 1920-21, Can. Bridge Works; 1921-22, Bursel Wheel & Foundry, Detroit, Mich.; May to Sept. 1922, Morava Constrn. Co., Chicago, Ill.; 1922-23, also Apl. to Sept. 1924, Whitehead & Kales, Detroit; April to June 1923, Kenwood Bridge Co., Chicago, Ill.; June to Aug. 1923, J. Henser, Chicago, Ill.; Aug. 1923 to Apl. 1924, i/c engineering squad in dfting and design; 1924-25, checking theatre constrn. with A. E. Yokom, engr., Detroit; 1925-26, Lewis Hall Iron Works; Feb. 1926 to present time, own office for designing and detailing structural steel.

References: A. E. West, F. Stevens, G. V. Davis, F. K. Kester.

LOMER—GERALD B., of Montreal, Que., Born at Montreal, Que., May 5th, 1886; Educ., B.Sc., McGill Univ., 1910; 1910-15, C.P.R. steam engr.; 1915-18, Can. Explosives Ltd., steam engr.; 1918-19, Wayagamack Pulp & Paper Co., steam engr.; 1919-20, Smetch, Hinchman and Grylls, Detroit, Mich., as designing engr.; 1920-22, Riordon Pulp & Paper Co., steam engr.; 1922-26, with E. B. Eddy Co., steam engr.; at present, steam engr. with Power Corp. of Canada.

References: R. F. Howard, D. F. Graham, I. R. Tait, J. W. Hughes, J. A. Shaw, G. M. Wynn, C. M. McKergow.

PATTERSON—GORDON STEWART, of Westmount, Que., Born at Montreal, Que., Sept. 18th, 1885; Montreal High School, Science, 1899-02; Metallography, 1921-22, and Metallurgical Analysis, 1925-26, McGill Univ. extension courses; 1902-07, dftsman, steam locomotive design, motive power dept., G.T.R.; 1907-10, dftsman, telephone apparatus and equipment, Northern Electric Co.; 1910, foreman dftsman, central office telephone equipment, same Co.; 1910-12, engr., central office tel. equipment; 1912-13, final check of specifications and drawings, engr. tel. central office equipments; 1913-24, design and adaptation of central office manual tel. apparatus and manual and automatic substation equipment; 1924-25, acting head, apparatus engrg. dept.; 1925 to present time, acting head, transmission engrg. dept.

References: H. J. Vennes, W. C. Adams, P. F. Sise, J. D. Hathaway, J. S. Cameron, A. J. Lawrence, W. D. Staveley.

SMITH—GEORGE BARNETT, of Belleville, Ont., Born at Wolverhampton, England, Aug. 18th, 1876; Educ., B.Sc., McGill Univ., 1900; 1902-09, with Mtl. Light, Heat & Power Co., in Test Dept., inside Meter Dept., Construction Dept., laying out circuits and revising them; Operation Dept. i/c substations receiving power from Lachine Rapids and Shawinigan, i/c overhead and underground line constrn work; 1909-10, with Smith, Kerry & Chase, on design and inspection of transmission line work; 1910-16, supt. i/c electrical dept. of The Electric Power Co., with supervision over the operation of transmission line and power house operation and mtce., etc.; 1916 to date, i/c Central Ont. system of H.E.P.C.

References: R. L. Dobbin, A. L. Killaly, R. M. Wilson, B. L. Barns.

STEVENS—ROBERT HERBERT, of Edmonton, Alta., Born at Weymouth, Dorset, England, Jan. 21st, 1883; Educ., High School, Cambridge and South Kensington exams., articled as surveyor and civil engr. in office of Borough surveyor and engr. of Weymouth and Melcombe regis., 1897-1902; 1902-03, asst. in same office; 1903-04, surveyor, etc., with E. C. Kerridge, Weymouth; 1904, bridge work and engrg details in county surveyor's office, Wimbourne; 1911-19, engrg. asst. in London County Council spring gardens, steel work section, asst. in Edmonton City Waterworks Dept., i/c all water main constrn., statistics and development of system; 1921-26, asst. in Waterworks office, City of Edmonton, supervision and design water main constrn., statistics, plans and details, etc.

References: A. W. Haddow, R. Gibb, W. H. Cunningham, G. R. Dalkin, O. Inkster.

WILLIAMS—HUGH CHESTER, of Chatham, Ont., Born at London, Ont., Mch. 8th, 1891; Educ., private and boarding schools, I.C.S. course in railroad engrg.; 1907-10, chainman, rodman, C.P.R.; 1910-11, dftsman, leveller, transitman, St. Lawrence River Bridge, double tracking, pneumatic caisson work, C.P.R.; 1911-14, transitman and i/c location and constrn., C.P.R., Sudbury to White River; 1915-19, lieut. C.E.F. Can. Engrs. and Pioneer companies on railroad constrn.: 1919-26, i/c road constrn., bridges, etc., Dept. of Public Highways, Ont.; at present, asst. to res. engr., Dept. of Pub. Highways, Ont.

References: S. B. McConnell, G. A. McCubbin, J. H. Forbes, G. Hogarth, A. A. Smith.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

KENDALL—RALPH, of Glace Bay, N.S., Born at Louisburg, N.S., June 20th, 1889; 1908-16, I.C.S. complete civil engrg. course, part of I.C.S. course in mech. engrg., 1911, half term in N. S. Tech. Coll., general engineering subjects; 1907-09, inc. rodman, chainman and picketman, etc., with Smith, Kerry & Chase on railroad location, water power development, etc.; with Dom. Iron & Steel Co., Sydney, on general steel plant constrn.; 1909-11, with Dom. Iron & Steel Co., general plant work (tracks, foundations, etc.); 1916, transitman with Can. Steel Corp., Ojibway, Ont.; 1917-19, inc. general drafting and designing with same company; 6 mos. constrn. supt. and engr. i/c turbo-steam plant installation and 11-storey bldg., Wallbridge Aldinger Co., Detroit, Mich.; 5 yrs. general foreman and asst. supt. on constrn. work on ry. bridges, factory bldgs., irrigation dams, flumes, etc., in Que., Ont. and Alta.; 1920-22, erecting engr. on steam turbine installation and general constrn. engr. for Dom. Coal Co.; 1922 to date, i/c surface surveying and civil engineering work for Dom. Coal Co.

References: A. L. Hay, W. Herd, M. J. Butler, W. H. Baltzell, D. H. McDougall.

KOHL—GEORGE HUTTON, of Sault Ste. Marie, Ont., Born at Montreal, Que., Dec. 21st, 1889; Educ., B.Sc., McGill Univ., 1910; 1909 (summer), elect. dept., Illinois Steel Co., Joliet, Ill.; 1911-12, test dept., Can. Westinghouse Co., Hamilton; 1912-14, field work, Prince Rupert Hydro-Electric Co. power site, transmission line surveys, preliminary design, steam flow measurements; 1915-19, commission in Royal Engrs.; 1919 to date, hydraulic engr. with Spanish River Pulp & Paper Mills Ltd.

References: C. H. L. Jones, W. S. Lea, C. H. Speer, J. D. Jones, J. L. Lang, P. S. Gregory.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

INGS—JASPER H., of Smokey Falls, Ont., Born at Charlottetown, P.E.I., July 15th, 1902; Educ., B.A.Sc., Univ. of Toronto, 1925; 1920 (summer), C.N.R. mtce. chainman; 1921 (summer), Dom. Shipyards, Toronto, asst. mech.; 1922 (summer), chainman, Frank Barber & Assoc.; 1923, 24 and 25 (summers), rodman and instrumentman, Duke-Price Power; Mch. to June 1926, rodman, Morrow & Beatty Ltd.; at present, res. engr. on Section 7 of Kapuskasing-Smokey Falls Ry.

References: C. H. Rust, A. C. Blanchard, G. B. Dodge, C. R. Young, R. W. Angus.

MOULTON—REGINALD HEATH, of Montreal, Que., Born at Coaticook, Que., Mch. 20th, 1902; Educ., B.Sc., Queen's Univ.; 1923-24, engrg. dept., Can. Ingersoll Rand Co., Sherbrooke, Que., dfting and mech. design on air compressors and centrifugal pumps; Mch. to May 1925, asst. to efficiency engr., Can. John Manville Co., Asbestos, Que., in asbestos mines; 1924-25, traffic engr. on installation of automatic telephone system, Bell Tel. Co., Montreal; 1925 to present, special studies on traffic and cost results, Bell Tel. Co., Montreal.

References: L. M. Arkley, L. T. Rutledge, E. L. Cote, H. C. Nourse.

MURTHA—LEO, of Woodstock, Ont., Born at Lindsay, Ont., July 6th, 1896; Educ., first yr. Arts, Univ. of Toronto, completed first 2 yrs. civil engrg. S.P.S. Toronto, 1923; Apl. to Aug. 1921, chainman and rodman on municipal work, Frank Barber and Assoc., Toronto; 1921, 6 weeks at Gull Lake survey camp on 3rd yr. survey work, U. of T.; Oct. 1921 to Dec. 1922, with Frank Barber and Assoc. as dftsman on municipal work; Feb. 1923 to date, with Can. Inspection & Testing Co. Ltd., Toronto, i/c inspection and testing in the mfr. of concrete sewer pipe at plant of Independent Concrete Pipe Co. Ltd., Woodstock, Ont.

References: C. R. Young, R. O. Wynne-Roberts, R. J. Marshall, J. Vance, F. C. Ball, W. G. Ure.

THE

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THE JOURNAL OF
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The Mineral Deposits of the Rouyn-Harricana Region in Western Quebec

The Physiography and Geology of Western Quebec, the Occurrence of Mineral Deposits and Present Extent of Development

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Paper to be presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

Quebec, the largest province of Canada, comprises an area of 706,834 square miles, or 452,000,000 acres, to use the figures given by the federal government authorities. Of this large area, the physiographic feature which stands out most prominently is the Laurentian plateau, which occupies in Quebec 95 per cent of the entire superficies of the province. In fact, if you join the cities of Quebec and Ottawa by a straight line, then follow up the Ottawa river to Mattawa on the west and down the north shore of the St. Lawrence to the east of Quebec city, the whole of the area of 670,000 square miles to the north is occupied by the Laurentian plateau, leaving only 36,000 square miles for the two other physiographic regions of the province, viz., the flat plain of the St. Lawrence lowlands, in the St. Lawrence valley, and the sharply-folded and mountainous Appalachian region, which latter extends from lake Champlain to the eastern end of Gaspé peninsula.

The 670,000 square miles of the Laurentian plateau in the province of Quebec are occupied by the oldest rocks known, classified collectively under the name of pre-Cambrian rocks. That they are the oldest, few will doubt who read the last presidential address of the Royal Society of Canada, in which Dr. Parks, of the University of Toronto, assigns to the youngest of the pre-Cambrian rocks the venerable age of 550,000,000 years. To the oldest he gives a tentative age of one and one-half billion years. Such are the ages of the rocks which constitute the banks of the Saguenay river, and of those over which fall the waters of the Montmorency river at its mouth, and of the Laurentian hills which constitute the background of the landscape to the northeast of the city of Quebec.

The great majority of these pre-Cambrian rocks consist of light coloured, usually reddish, rocks coarsely crystalline in texture, of the granite family. They often present a banded or striped structure, called gneissic structure. These granites, massive as well as gneissic, to which the term Laurentian was formerly applied are, as a rule, barren of metallic minerals. On the sketch map figure No. 1 they are designated by "A." But associated with them are patches, (*1*) of fine-grained dark green to black rocks of the Keewatin formation, the oldest known, consisting of volcanic rocks mostly thick lava flows, sheets of basalts, andesites, porphyries, usually deeply altered and metamorphosed; (*2*) of sedimentary rocks, conglomerates, sandstones, limestone altered into quartzites, slates, crystalline limestone and other metamorphosed rocks designated as Grenville and Temiscamingue formations; (*3*) of dark coloured coarse-grained igneous rocks, diabases, diorites, gabbros, norites; (*4*) sedimentary rocks, conglomerates, quartzites, slates of the Cobalt series.

These patches of dark grey to dark green igneous rocks, fine- or coarse-grained, and of sedimentaries, are of all sizes from a few square feet to thousands of square miles. They are indicated by A1, A2, A3 on the map figure No. 1. Contrary to the lighter coloured granites and gneisses, they usually carry metallic constituents which are liable to be segregated, collected together, in sufficient concentrations to give rise to workable metalliferous deposits. These may be looked upon as mineralized islands, dotting, so to speak, a sea of lighter colored granites and gneisses, which for the most part are unmineralized, or in which the metalliferous elements are too scattered or disseminated to be worked economically. It is in these mineralized islands, or patches, of dark rocks, that we find the silver deposits of Cobalt; the gold deposits of Porcupine and of Kirkland lake; the nickel deposits of Sudbury; the copper and zinc deposits of Flin-Flon; the copper of Bruce mines; the lead and zinc ores of Portneuf county and of the Chelmsford region; the old

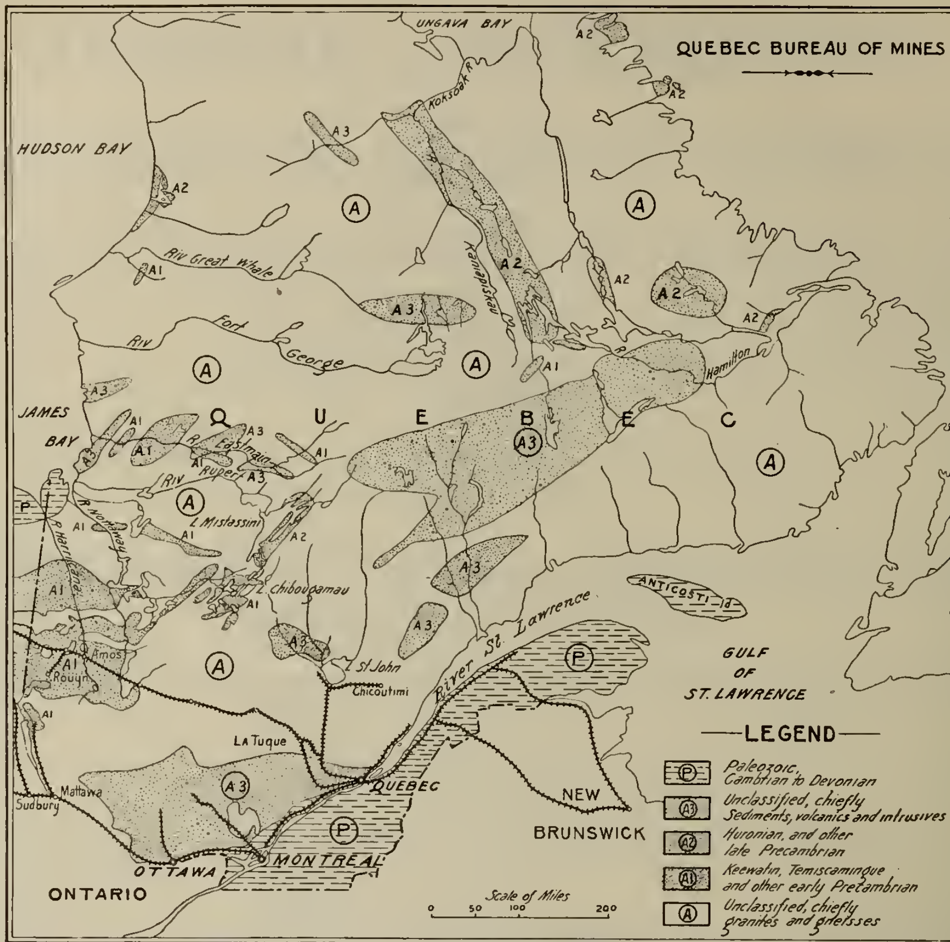

Figure No. 1—Geological Sketch Map of the Province of Quebec, Showing Relative Distribution of Pre-Cambrian Rocks (*A*, *A1*, *A2*, *A3*) and of Paleozoic Rocks (*P*).

silver deposits of the lake Superior district; the large iron deposits of Michigan, Minnesota and Wisconsin; the copper-gold-zinc deposits and the gold ores of the Rouyn-Harricana district of western Quebec.

The chronological geological table of the pre-Cambrian while still a controversial matter among geologists, might probably be constituted somewhat like the following, in descending order, the Keewatin being the oldest and the Keweenawan basic intrusions the youngest.

Keweenawan basic eruptives.
Iron series of lake Superior.
Sudbury nickel eruptives.
Basic dykes and sills (diabase).
Cobalt sediments.
Algoman granites, diorites, syenites, porphyries.
Gabbros and basic dykes.
Temiscamingue sediments.
Laurentian granites and gneisses intrusives.
Grenville crystalline limestone, quartzites and slates.
Keewatin volcanic flows and sheets, and a few sediments.

The above table of geological sequence is more or less conventionalized, for geologists have not yet reached perfect agreement as regards the nomenclature of the pre-Cambrian. The pre-Cambrian epoch was eminently characterized by great igneous and eruptive activities, disturbances and invasions. Periods of sedimentation were followed by periods of intrusion, invasions and flows of molten, pasty, rock magmas, which, on cooling, formed massifs, dykes, flows, sheets of igneous rocks, such as basalts, andesites, rhyolites, granites, gabbros, porphyries, according to their composition, the way in which they invaded and penetrated the pre-existing rocks and the rate of cooling.

Modes of Occurrence of Mineral Deposits

These high temperature igneous magmas, or molten rock-matrix, coming from sources below the earth's crust, are all metal-bearing, to a more or less degree, according to their composition. They are the mineralizing agents which form the mineral deposits. With the metals these magmas also carry large quantities of sulphur. Mineral deposits, therefore, formed under high temperature or medium temperature conditions, are generally sulphides, such as iron pyrites, (FeS_2); chalcopyrite, ($CuFeS_2$); galena, (PbS); zinc blende, (ZnS); molybdenite, (MoS_2); argentite, (Ag_2S). Gold, however, does not combine with sulphur and is found native even when it is mixed with the sulphides, as it often happens.

The metalliferous sulphides only constitute a very small proportion of the igneous molten mass, and if the latter cooled quickly in a solid mass the metallic minerals would be too thinly disseminated to constitute workable ore bodies. To give rise to such deposits there must be present certain conditions which cause a concentration of the sulphides, and dispose them into masses large enough and rich enough to be economically mined. In a crude way, it may be said that there are two main processes of concentration of the metallic contents of igneous magmas into ore bodies, viz.: (*1*) filling of fissures and spaces in the rocks of the earth's crust; (*2*) replacements, by chemical action, of parts of the invaded rock-beds by the metallic elements of the eruptive magma.

Igneous magmas, when deep down below the surface, miles down, are under tremendous pressure and high temperature. When such masses find their way upwards, towards the surface of the earth's crust, conditions of pressure and temperature change, the equilibrium of the magma is disturbed. Under such circumstances, certain phenomena of breaking up of the molten mass take place. Emanations, fluid and gaseous, are produced which find their way upwards through any small fissure, crack, opening and zone of weakness. These magmatic emanations carry gold, silver, sulphides of metals and gangue materials of various nature, silica, carbonates, alcaline salts. When these solutions reach wider open fissures, under conditions of lower temperature and greatly diminished pressure, they abandon, by precipitation and evaporation, their less soluble elements, effecting thereby a sort of natural concentration of their constituents, and forming, by filling of the open fissures, the mineral deposits designated as "fissure veins."

In the replacement process of mineral deposits formation, the action takes place in depth, under conditions of high pressure and high temperature. In many cases, as may be imagined, the molten magmas issuing from deep-seated reservoirs and invading the rocks which form the solid crust of the earth do not always find their way to the upper levels, to break up into solutions and other emanations which fill up pre-existing fissures and cracks. They may remain at great depths where they would retain their temperature and pressure for a long time. They cool very slowly, and the contact zone presents extensive alterations, the magma having attacked, eaten into, digested, absorbed the invaded rocks, more especially when an acid magma, rich in silicic acid, is injected through basic rocks, that is, carbonates and silicates of iron, calcium, aluminium, setting up chemical reaction between them. In such zones, metallic deposits are formed, the rock having been slowly transferred and replaced by the precipitation of sulphides and gangue contained in the magma. The most common sulphides thus precipitated and concentrated by replacement processes are pyrrhotite, pyrite, chalcopyrite, zinc-blende, galena, which carry down with them the gold and the silver when the mineralizing magma contains them. The shape of such deposits is not as regular and continuous as those formed by the filling of fissures, the width, length and depth of the latter being much more even and persistent than the bunchy, pockety, lenticular replacement deposits. Replacement deposits have given rise to some of the largest mines in the world.

These two modes of formation of mineral deposits are, in nature, seldom clean cut and definite. In most cases both processes have had some part in the genesis of the ore-deposit. Given a metal bearing molten mass, injected into the rocks forming the crust of the earth, the replacement mode predominates in the formation of metallic deposits in the immediate neighbourhood of the magma, while fissure-filling becomes more and more prevalent and definite as we recede from it. The two processes merge and grade into one another, depending on the composition and the physical condition of the invaded rocks.

General Geology

In the western Quebec new mineral field, which spreads out from the interprovincial boundary to the Bell river and from 10 to 15 miles north of the Transcontinental Railway to 40 or 50 miles south of it, the rocks consist of Keewatin lava flows, both basic and acid; tuff beds of volcanic ash and dust; Temiskaming sedimentary beds; all of these having been intruded, penetrated, and cut by masses, necks and dykes of igneous rocks, granite, diabase, gabbro, diorite-porphyry, syenite porphyry, lamprophyre.

Keewatin

In the rocks of the Keewatin period, the lava flows predominate. They consist mainly of basic dark-green to black fine-grained rocks such as basalts and andesites, interbedded with, and grading into, more acid flows of trachyte, rhyolite and dacite, with occasional intercalations of tuff beds, all of which are dark grey to creamy in colour.

According to Dr. H. C. Cooke, from whose reports on the geology of the region the data for the following notes have been taken and condensed, the Keewatin period was one of active vulcanism during which thick flows of lava, following each other with considerable rapidity, poured out and piled up in layers on top of one another, to such an extent that at Dasserat lake a total thickness of four miles of lava beds has been observed, without any sign of the bottom nor the top beds. These extrusions were submarine, as indicated by "pillow" structure in the lavas.

With the end of the extrusion period began a regional uplift movement of the earth's crust, which raised the consolidated lava flows above the sea level and folded them. Once thus raised and folded the surface was subjected to

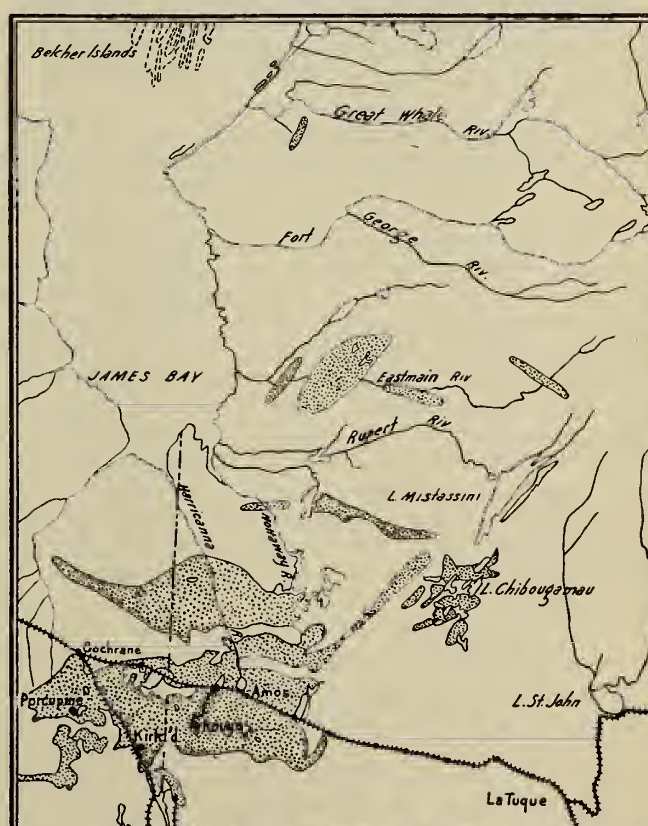

Figure No. 2—Sketch Map of Keewatin Volcanics and Schist Complex in Western Quebec, Showing Geological Relation with Porcupine and Kirkland Lake Districts.

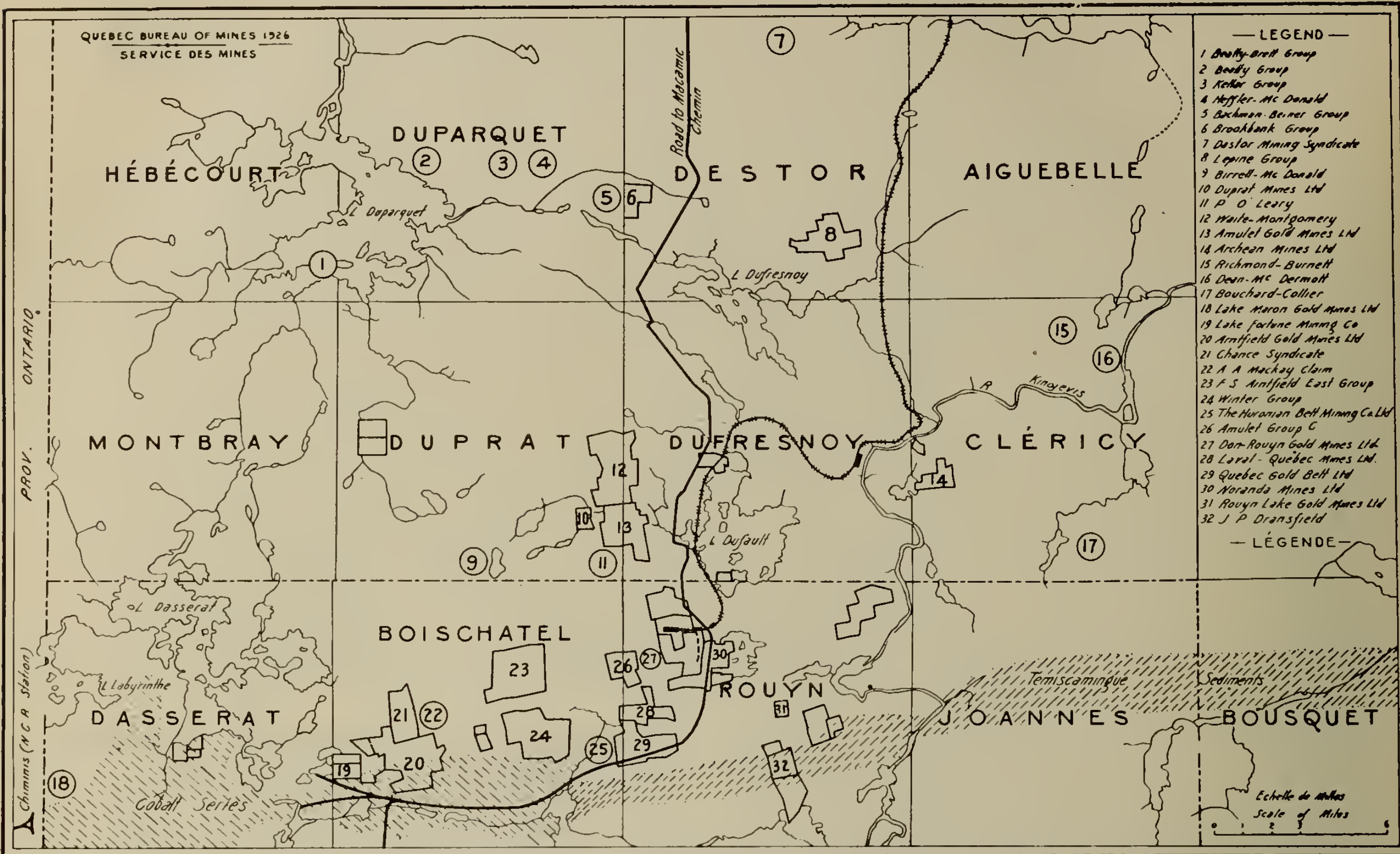

Figure No. 3—Western Quebec—Sketch Map of Western Part of Mineral District Showing Railroad from Taschereau to Rouyn, and Waggon Road from Macamic to Angliers.

violent erosion, which was all the more rapid for the entire lack of vegetation. "The land," says Dr. Cooke, "at that time must have been a scene of unimaginable desolation; black lava everywhere, carved no doubt by the weather into cliffs, spires, and an infinite variety of weird shapes; with the gloomy tints of basalts relieved here and there, it is true, by the lighter colours of rhyolite or dacite, but without a trace of the soft green of vegetation; with the surface everywhere piled high with blocks, boulders and masses of rock, from between which almost every particle of soil had been swept by running water. From the mountains rushed torrential streams, black with lava mud, and rolling quantities of gravel and boulders along their beds to the plains below."*

Temiskaming Sedimentation and Subsequent Earth Movements

It was during that period of violent erosion that the deposition of the Temiskaming sedimentary beds took place. After the formation of this series came intense horizontal thrusts which sharply folded the Keewatin lava flows and the overlying Temiskaming sedimentary beds, turning them on edge, from the original horizontal position. This was followed by the intrusion and invasion of various igneous rocks, gabbros, granites, syenites, porphyries and lamprophyres. The intrusions of granite were specially vast and widespread. Enormous volumes of molten magma slowly ate their way upwards through the overlying Keewatin and Temiskaming rocks. In fact in the region south of the remaining band of Temiskaming sediments the granite magma ate up and digested the whole of the lava flows, and of the 7,000 feet of Temiskaming beds resting on the lavas. This period must have been a very active one of metallization of the pre-existing rocks.

The period of intense folding which preceded the magmatic invasions, had converted that part of northern Canada into a mountainous country, with peaks and ranges equal to the Alpine and the Himalayan regions, for according to Dr. Cooke the subsequent erosion, which wore down and reduced the level of the country to a plateau near sea-level, must have removed a thickness of rocks which he estimates at 14,000 feet as minimum and 30,000 feet as maximum. This new plain-like surface therefore, uncovered and exposed outcrops of remnants of Keewatin, of Temiskaming formation and massifs of intrusive rocks which formerly were covered by several thousand feet of overlying rocks.

Mineralization and Ore Bodies

Apparently the period of mineralization of the Keewatin lava beds and of the Temiskaming sediments followed immediately the violent thrusts and earth movements which folded sharply and turned on edge these formations. The axes of the folds in the region were east and west, for the edges of the lava flows and of the Temiskaming beds which formed the surface after the intense planing off of the ridges, domes and mountains by erosion, are oriented east and west.

The ore-bodies in the new mineral district of western Quebec are partly true fissure veins, partly true replacement lenses and partly deposits which owe their origin to a combination of the two processes. The beds of the tougher, hard lavas such as the grey lavas, rhyolite and

* H. C. Cooke.—Geological Survey of Canada, Summary Report 1922, p. 59D.

trachyte, as well as the grauwacke beds which constitute the majority of the Temiskaming sedimentaries, were fissured without much shearing or shattering. Their composition is not such that they would be attacked and replaced by an acid magma, so that the deposits which formed in them are more of the true fissure vein type. Such are most of the deposits in Dubuisson township, in Bourlamaque, in Barraute, in Fournière, in Cadillac, as well as some of the deposits in Rouyn and Boischatel, the ore, or vein filling, consisting of quartz gangue, mineralized with free-gold, pyrite, pyrrhotite, chalcopyrite, sometimes tellurides, occasionally arsenopyrite, and often accompanied by carbonates, tourmaline needles in the quartz, and hornblende. Good examples of such deposits are the Stabell, the Unison, the Siscoe in Dubuisson township; the claims of the Fournière Gold Mines, Ltd., and of the Malartic Mining Company in Fournière township; the O'Brien mine and the Thompson claims in Cadillac township; the Powell vein and the Chadbourne claim in Rouyn township; the Lake Fortune mine in Boischatel and many others.

Among the outstanding examples of ore bodies formed by replacement of the rock, may be cited the Horne mine in Rouyn township; the Waite-Montgomery claims and the Amulet property in Dufresnoy and Duprat townships; the Alderson-Mackay claims in Boischatel township, which all show lenses of solid sulphides, consisting of pyrrhotite, pyrite, chalcopyrite and zinc blende, many of them gold-bearing. These lenses, or series of lenses, affect all shapes and sizes, the ones of the Horne mine (Noranda Mines, Ltd.) have so far been developed sufficiently to show ore-bodies containing one million tons of ore of an average content of $5.50 in gold and $19 in copper. Some parts of these lenses, as exposed in underground workings of the mine are of solid chalcopyrite, which contain copper to the value of $90 per ton, apart from the gold which would probably add $2 to $5 a ton. The Horne is here cited because it is the pioneer successful property in Rouyn and its development is the most advanced in the region. It has two shafts, one of which is down 330 feet, and the underground drifts and cross-cuts total a length of nearly two miles. But the other ore bodies of this type have a very promising appearance from the comparatively little work done on them.

Other deposits partake of the characteristics of both replacement and fissure vein type, such as the Arntfield claims; the Francœur claim in Boischatel; the McMillan claim in Rouyn.

The prospectors were attracted to the district in 1922 by the possibilities offered by the quartz veins of the fissure type, along the extension into Quebec of the mineralized zone in which are situated the gold-quartz veins of Metachewan, Kirkland Lake and Larder Lake in Ontario, and for nearly two years the sulphide bodies were neglected. It was in the fall of 1923 that work was started in earnest on the Horne claim, with such results that the gold-quartz ore bodies have lost much of their importance in the eyes of prospectors, and that the lenses of solid sulphides of copper and zinc, accompanied by gold, are now sought for as being of greater promise of economic importance. It is quite probable that eventually the gold-quartz deposits will regain some of the ground that they lost in the esteem of the interested public, but at present the solid sulphide bodies of the Horne, of the Waite-Montgomery, of the Amulet, of the Alderson-McKay are greatly in the limelight, and with very good reason.

The claim on which is situated the Horne mine was

Figure No. 4.—Provincial Government Road from Macamic to Rouyn.

staked by an experienced prospector Mr. Edw. Horne as early as 1920. The story goes that Mr. Horne and his partner Ed. Miller were " grubstaked " by a syndicate of northern Ontario men, who comprised ten members, eight of whom put up in the vicinity of $500 each, and Messrs. Horne and Miller put in their experience and their work. In 1922 the claims were optioned to the Noranda Mines, Ltd., for $320,000 in cash, payable in various payments, the last one in 1928, and a tenth interest in any company formed to exploit the deposit. In February, 1926, by an agreement between the parties, $250,000 was paid to the syndicate, who received in addition for their one-tenth interest, 125,000 shares of Noranda Mines, Ltd., now selling in the vicinity of $20, or altogether a value of some $2,750,000. Needless to say, not all prospecting ventures are thus rewarded.

It is now assured beyond a doubt, that the Rouyn district, helped in all probability by other camps which will eventually develop in the mineralized region outlined between the Ontario boundary and the Bell river, will in a near future put Quebec in the ranks of the important producers of metals, copper, zinc and gold. At present the annual mineral production of our province, $24,000,000, is constituted by 95 per cent of non-metallic substances such as asbestos, mica, feldspar and building materials, and 5 per cent of ores of metals. But with the discoveries of the last three years in western Quebec, as well as with the development of the promising lead and zinc deposits of the Gaspé peninsula, the future of our metal mining industry is of the brightest and permits us to presage that before long the metalliferous products will equal in value the non-metallics and that the annual output of our mines and quarries will reach a value of fifty million dollars.

If we look further into the future the mineral possibilities of Quebec are even greater. The Rouyn-Harricana district constitutes only the southern fringe of a vast area

Figure No. 5.—Town of Rouyn in July, 1926.

of 10,000 square miles of Keewatin rocks which extends for fifty miles north and south of the Transcontinental Railway. Other vast patches of rocks known favourably as possible mineral bearers, designated on the geological sketch map as A_1, A_2 and A_3 occupied mainly by the Keewatin, Grenville, Temiscamingue, Huronian, Keweenawan formations have been roughly outlined by our Canadian geologists. These areas of mineral possibilities occupy 75,000 square miles of the Laurentian plateau, and it is not an exaggeration to state that they offer to the hardy prospector a field unequalled anywhere else in the world.

The effects of promising mineral discoveries and of the establishment of a mining camp on the development of a region have been vividly demonstrated in the case of the Rouyn district. In 1923 it was a wilderness, remote from means of communications, bush covered, uninhabited and frequented only by prospectors. Tents, and a few log cabins sparsely scattered over an area of hundreds of square miles, were the only shelters. The first active development work in the region was started on the Horne claim in the fall of 1923, and in 1926, three years later, a 45-mile railway spur was in operation from the Transcontinental Railway to the centre of Rouyn township; a waggon road was opened from Macamic, on the Transcontinental, to Angliers, the terminus of the Canadian Pacific Railway in Temiscamingue, a distance of one hundred miles; a town has sprung up, which now has 450 buildings and a population of 2,500; a neighbouring site has been subdivided according to modern principles of town planning; water-works and sewerage systems are being put in; an electric-power line, sixty miles long, delivers power and light; a smelter to treat 1,000 tons of ore a day is under construction and is expected to be in operation within a year; a telephone service gives speaking connection with all the centres in Ontario and Quebec.

The Rouyn district is just now experiencing a period of boom, and, as in all such cases, along with the promising, healthy mineral discoveries there are, unfortunately, a multitude of parasitic ventures, whose main object is to mine money out of the excited public rather than ore from the ground. This cannot be avoided; it is very difficult to prevent fools from parting with their money. For, history repeats itself, and the ultimate result of the Rouyn boom will be a few good outstanding producing mines and a healthy smelting industry, which will prove a national asset, and a multitude of claims which will never produce ore, but will have been used to exploit the public. As in all victories there will be individual casualties, but the establishment of the mining and smelting industry will, of course, be a source of prosperity to the country.

As a rule the promising mineral discoveries and likely claims, in the Rouyn district, do not have to resort to making appeals to the public for funds to explore and develop them. The Rouyn camp is not "a poor man's camp," like the Klondike, or even the Cobalt camp. It requires very large sums of money and the best technical knowledge available, to do exploration work on these copper-zinc-gold deposits. Fortunately there are several powerful companies interested in the field. These can procure the best technical help obtainable, both geological and operating, and such organizations do not publish full-page advertisements, advising the public to get in on the ground-floor at 10, 15 or 25 cents a share, nor do they send peddlers from door to door, selling beautifully-engraved certificates of mining companies with alluring sounding names. One may be sure that very little of the money obtained by such means is put into honest, effective work on the claims.

In concluding, the author wishes to pay a cordial tribute of appreciation to the work of geological and topographical mapping which has been carried on for the last four years by the Geological Survey of Canada in the new western Quebec mineral region.

The general planning of this work is under the direction of Dr. W. H. Collins, director of the Geological Survey, with Dr. H. C. Cooke as senior geologist. During the field-season of 1926 this federal service had five distinct field-parties, geological and topographical, working in western Quebec, with the object of mapping the whole region in a series of detailed sheets, on a scale of one mile to the inch. Several of these geological sheets, with accompanying reports, have already been issued, and have proved an inestimable help to the public interested in the development of our mineral resources.

This series of maps and reports was preceded, several years before its inception, by excellent general descriptions and maps of the country, by Dr. M. E. Wilson for the Geological Survey of Canada, and Dr. J. A. Bancroft for the Quebec Bureau of Mines.

The Metal Mining Industry of Northern Ontario

An Historical Review of the Development of the Industry

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Paper to be presented at the Annual General Professional Meeting of the Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

Introduction

The mineral industry of the province of Ontario has been marked by steady growth, with some fluctuations owing to the general state of business, and in late years, to war and post-war abnormal conditions. The following table, beginning with production for the year in which the Ontario Department of Mines was established, records the facts on a valuation basis:—

Mineral Production of Ontario by Five-Year Periods

Year	Metals	Non-metals	Total
1891	$ 388,715	$ 4,316,958	$ 4,705,673
1896	963,288	4,271,715	5,235,003
1901	5,016,734	6,814,352	11,831,086
1906	13,353,080	9,035,303	22,388,383
1911	29,102,867	12,873,930	41,976,797
1916	55,002,918	10,300,904	65,303,822
*1921	28,777,581	25,786,728	54,564,209
**1926	61,000,000	26,000,000	87,000,000

As to variety of mineral products, it may be stated that Ontario possesses practically all the economic metals with the exception of tin and most non-metals with the important exception of coal. It is not the purpose of this paper to discuss non-metallic minerals, other than to point out that in recent years these have had a valuation of approximately $25,000,000 per annum, and that it was not until the year 1905 that the output of metals exceeded in value that of non-metals.

Ontario holds first place among the provinces of Canada as regards mineral production, having taken the lead from British Columbia in 1907. In the year 1925, Ontario produced 39 per cent of the total mineral output of Canada, British Columbia 29, Alberta 11 and Quebec 10 per cent. As to individual metals, Ontario leads at the present time in output of gold, nickel, platinum metals and cobalt, while supremacy in silver has been won, for 1926 at least, by British Columbia.

The following data, abstracted from the Canada Year Book for 1925, shows the relative monetary importance of the main sources of primary production for the year 1923 in Canada:—

Agriculture	Forests	Mines	Fish and Game
$1,107,571,858	$313,748,937	$214,079,331	$58,730,104

Compared with agriculture, mining may appear a small industry, but it is a pioneer industry, searching out our unexplored areas, and development in other lines follows in its wake. The search for metals in northern Ontario, following the finding of silver at Cobalt in 1903, has resulted in important mineral discoveries in South Lorrain, Gowganda, Porcupine, Kirkland Lake and many lesser camps.

* Year of post-war depression. ** Estimated.

Railway construction has kept pace with the needs of these new mining communities, and in this connection the Temiskaming and Northern Ontario Railway, belonging to the Ontario government, has played an important part.

Historical Sketch

No discussion of metalliferous mining in Ontario would be complete without a brief historical review touching the early days of the industry.

Iron

Metal mining in Ontario had its beginning on the Gananoque river at Furnace Falls, (now Lyndhurst), in the county of Leeds, where an iron furnace was erected about the year 1800*. An attempt was made, with ore of inferior quality, to make cast hollow ware, such as pots and kettles, for the use of settlers, but the enterprise proved a complete failure. A second venture was made in 1813 to utilize the bog iron ores of Norfolk county, and for this purpose a crude plant was erected at the mouth of Potter's creek, in the township of Charlotteville, where waterpower was available and lake transport convenient. Only a few tons of pig iron were smelted when the furnace lining gave way, and the project was abandoned, to be taken up later, however, by Joseph Van Norman and his associates, who repaired the furnace and re-started smelting in the year 1822. This furnace was operated until 1847, when it was shut down owing to scarcity of ore and fuel. The enterprise latterly was conducted by J. Van Norman and Son, the name Normandale being given to the locality where business was carried on. The furnace was in blast for 8 or 9 months each year, producing 700 to 800 tons of pig iron annually, which required charcoal fuel from 4,000 cords of hardwood. Ore hauled by wagons, came from within a range of 12 miles. Daily ore consumption was about 9 tons, and the yield 3 tons daily on the average of an excellent quality of pig iron. Various castings were made on the spot, such as stoves, sugar and potash kettles, and these were distributed to settlers along the north shore of lake Erie and taken to the interior by teams. Some export business with Buffalo and Chicago was developed when the home market became overstocked.

An unsuccessful attempt to treat magnetic iron ore at Blairton, on Crow lake, in the township of Marmora, was made about 1820. Van Norman was induced to buy the property and furnace in 1847, after closing down at Normandale. The purchase price was $21,000. After a further large expenditure in furnace fittings, blowing apparatus and general repairs he got the furnace started in 1848. But the iron output was small relative to fuel consumption, and transport for 32 miles over rough roads to Belleville was difficult. Another transport route was tried, via the Trent river to Rice lake, and then by road 12 miles to the dock at Cobourg. The product sold at $30 to $35 per ton. Un-

*Some records say 1810.

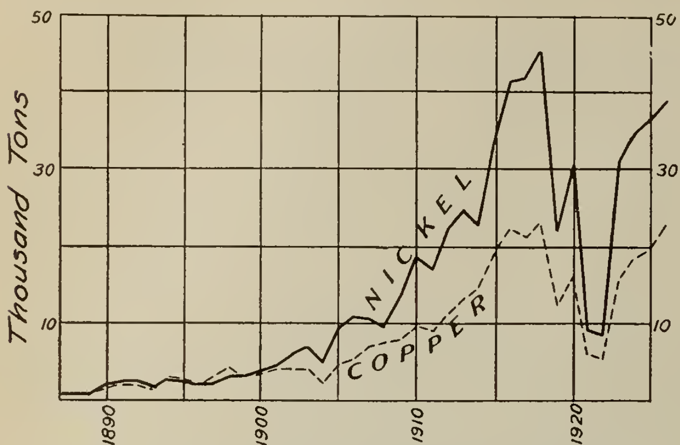

Figure No. 1.—Graph Showing Nickel and Copper Content of Matte Produced from the Inception of Smelting at Copper Cliff in 1887.

fortunately for the enterprise, foreign pig iron was soon available at Cobourg and Belleville at $16 per ton, as a result of the completion of the St. Lawrence canals. The Marmora plant was forced to close down, with a total loss to Van Norman. Subsequent efforts by other companies up to about 1875 resulted in failure, due principally to poor transport and antiquated methods which made costs prohibitive.

In 1837 a charcoal blast furnace for smelting magnetic iron ore was erected at Madoc, in Hastings county, as a result of successful experiments conducted at Wolcott, in New York state, on sample lots of ore from the Seymour mine in Madoc township. Some good cast iron was produced, and also pig iron which sold at $27 per ton in Belleville. Primitive methods and experimental work, complicated by litigation, made costs prohibitive and resulted in abandonment of the enterprise. In fact, Ontario's early iron mining was a series of failures, demonstrating that someone must pay for experience. Commenting on the failure of the Steel Company of Canada in 1885, the editor of the Charcoal Iron Workers' Journal said: " It is seldom that pioneers in iron manufacture in any region are successful, and almost every iron-producing district in the United States has a graveyard of buried hopes and expectations." Such was the beginning of the iron industry in Ontario. Space will not permit reference to later successful blast furnace operation and steel production at Sault Ste. Marie and Hamilton.

Copper

Turning to the early days of copper mining, it appears that although the presence of copper on both sides of lake Superior was mentioned in narratives of Jesuit missionaries over a century prior to the abandonment of the first mining operations near Mica bay in 1773, no further attempt was made to find copper ore in Ontario until 1845. This effort was stimulated by the rich copper deposits of the Keweenaw peninsula in northern Michigan being developed, immediately following the extinguishing of Indian title in 1843.

In 1847 the Montreal Mining Company acquired the Bruce Mines location, on the north shore of lake Huron, and vigorously prosecuted mine development until 1850. Concentrating and smelting equipment was unsatisfactory, also the grade of ore proved to be lower than expected owing to the miners excavating more wall rock than necessary. After E. B. Borron was appointed manager in 1852, results were more satisfactory and profits were made in 1853-54, followed by losses in the two following years under old methods re-employed to speed production. Concentrates running about 15 per cent copper were shipped to England, and production continued on a limited scale until 1865, when the property passed to the West Canada Mining Company, after 20 years of unsuccessful effort at Bruce Mines, due principally to the deterioration of the veins at depth.

Silver

Silver Islet,—a tiny speck in lake Superior near Thunder cape,—belonged to the Montreal Mining Company in 1868 when the now famous discovery of silver was made. Some rich specimens were taken out that year and the vein prospected in 1869, but in 1870 the property was sold along with all their other mining locations to the Ontario Mineral Lands Company. Between 1870 and 1884 the Silver Islet deposit was worked to a depth of 1,230 feet and silver extracted to the value of $3,250,000. Again, silver was discovered in 1882 at Rabbit and Silver mountains, some 50 miles west of Fort William. Production continued until 1903, the gross output from the Port Arthur area, including Silver Islet, being 4¾ million dollars. Silver Islet was again worked in 1920 and 1922, some 16,879 ounces of silver being removed, chiefly from the roof of the old workings.

Coincident with the cessation of production from the Silver mountain area in 1903, another discovery was made which time has proved to be one of major importance. During the construction of the Temiskaming and Northern Ontario Railway from North Bay to tap timber areas and serve a small farming community at the head of lake Temiskaming, La Rose, a French-Canadian blacksmith who worked for a railway contractor, picked up a heavy piece of mineral with a coppery appearance in a rock cut at Long lake, later renamed Cobalt lake. This was examined in Haileybury by Thos. W. Gibson, director of the Bureau of Mines, in October, and forwarded to Willet G. Miller, late provincial geologist of Ontario, who identified the specimen as niccolite. Miller made a hurried trip, along with Wm. Nicol, professor of mineralogy at Queen's University, Kingston, to the new discovery in the late autumn of 1903, by way of Mattawa and lake Temiskaming. Meantime, some silver veins had been uncovered. Production from this famous silver and cobalt area, (one of the richest in the world), was rapid, and will be discussed in another part of this

Figure No. 2.—Sketch Map showing Wide Distribution of Gold in Pre-Cambrian Rocks.

Some twenty-seven distinct areas are shown where gold has been discovered, indicating wide distribution in pre-Cambrian formations.

paper. Silver mining at Cobalt was well established when finds were reported in 1906 from Maple mountain, Silver lake and Elk lake, to the northwest of Cobalt. Late in 1907, silver finds were reported from Gowganda lake, and also from Miller and Leroy lakes. The Miller lake section has since proved to be the backbone of the Gowganda silver area. Meantime, from South Lorrain, some 18 miles south of Cobalt, silver was found in identical geological conditions to those obtaining at Cobalt. Actual production from South Lorrain and Casey township began in 1908, while Gowganda developed more slowly,—not making shipments of moment until 1910. Both the South Lorrain and Gowganda camps have had checkered careers, the former taking on a new lease of life in 1921 and the latter in 1924.

Nickel

During construction of the Canadian Pacific Railway in 1883, in a railway cut near Sudbury, a find was made of mineral at first thought to be copper but later ascertained to contain nickel as well. This discovery, which became known as the Murray mine, proved a momentous one in the mineral history of the province, paving the way for other important discoveries in what is known as the Sudbury nickel basin, covering an area 20 by 50 miles. In 1886 the Canadian Copper Company was organized and the mining of copper ore actually commenced, but it was not until 1887 that the nickel content of the ore was recognized. At that time world consumption of nickel was about 1,000 tons per annum, supplied largely from New Caledonia ores refined in France. No process was then known for refining the Sudbury copper-nickel ores, but soon the Orford and Mond processes of separation and refining were in operation. Uphill work marked the early years of the nickel industry, both as regards metallurgical treatment and finding a market for the product.

Ontario's chief competitor in nickel production has been New Caledonia, an island 40 by 250 miles in size, belonging to France, and lying about 1,000 miles northeast of Sydney, Australia. Before the discovery of Sudbury ores, New Caledonia controlled the world's nickel market, and the same was true in respect of the metal cobalt prior to the finding of cobalt-silver deposits at Cobalt in 1903. Nickel was found to occur in economic quantities in New Caledonia in the year 1874, and shipments of ore were first made in 1875. Production from New Caledonia and Ontario was about equal between 1890 and 1904. Since then Ontario's output has grown steadily in importance, and for the past decade has represented from 80 to 90 per cent of the world's production. Since 1920, New Caledonia's production has been about 4,000 tons per annum.

Nickel steel used for armour-plate and ordnance absorbed about 50 per cent of the output prior to the Great War, and the year 1918 marked the peak of production when 45,886 tons of nickel were contained in ore smelted. Following the war, new peace-time uses for the metal had to be found and new markets developed. World production slumped to less than 10,000 tons in 1921, as a direct result of the Disarmament Conference, but has since risen

Figure No. 3.—Map Showing Pre-Cambrian Areas.

steadily to 40,000 tons in 1925. Now nickel steel for automobile manufacture and purposes other than war uses makes up 50 per cent of the total consumption. This wonderful come-back in four years is a tribute to splendid effort, engineering ability and scientific research applied to a problem that meant life or death for the nickel producers.

Gold

In 1866 gold was discovered in Madoc township, in Hastings county, on the farm of J. Richardson. This property and others along a narrow belt about 70 miles long have been worked spasmodically since that date, but with indifferent success. The ores are largely of the arsenical-gold type. Next, a find was made by Peter McKellar in 1871 in the township of Moss, some 75 miles west of Fort William. This became known as the Huronian mine, where a 10-stamp mill was erected in 1883 at great expense. Some milling of a good grade of ore was done in 1884, but a shut-down was forced in 1885 owing to difficulties of transportation. It is of interest to note that this property, lying idle all these years, was again being developed in 1926. This is a case where modern milling methods may make a success of a mine which failed in its early days of development.

Gold was discovered in the Lake of the Woods region in 1878 or earlier. Some mining was done near the north end of the lake during the next five years, but owing to the dispute between the federal and provincial governments over the ownership of this territory, it was impossible to secure title to property or money to finance development. This region attracted considerable attention in the late nineties, and the boom reached its peak in 1897, coinciding with the discovery of the Klondike placer deposits.

Ontario produced gold to the value of $424,568 in 1899, after which the output slumped off to $32,445 in 1909, the lowest ebb in the history of gold mining, in the same year in which Porcupine was discovered. It should be said in passing that some of these old gold properties should have a chance to make good since cyanide treatment, making better recovery possible, has been introduced in recent years. Prejudice, however, in view of past failures, is a difficult thing to overcome. For this very reason, many said we would never have important gold production from Ontario, and consequently the rich silver finds at Cobalt in 1903 distracted attention temporarily from gold.

The auriferous schist of the Hollinger mine had been tramped over for years by Hudson Bay officers and Indians in portaging across the route connecting the Mattagami and Frederickhouse rivers. In 1908 a gold find had been made on Porcupine lake, and this was followed in 1909 with the discovery by J. S. Wilson of the quartz dome from which the Dome mine took its name. In the same year, Benny Hollinger, Jack Miller and Alex. Gilles staked the property already referred to which later became known to the world as the Hollinger mine. To the end of 1925, the Hollinger produced over 99 million dollars and paid dividends in excess of 30½ million dollars. Sandy McIntyre staked the mine which bears his name.

Ore deposits in the Hollinger-McIntyre section occur in basic volcanic schists and at the Dome in a metamorphosed greywacke-conglomerate. In both cases ore is found near the contact of a schisted quartz porphyry of younger age which has intruded the older rocks. According to A. G. Burrows, provincial geologist of Ontario, who has made an intimate study of Ontario gold deposits, the intrusions have in some way influenced the deposition of gold, but probably have not been the source of gold-bearing solutions. Quartz veins serve as avenues of gold mineralization for both themselves and the schists, and are regarded as genetically connected with Algoman (young) granites and associated rocks of the region.

The most intense mineralization is usually along fracture planes in the quartz. The deposits are found in pronounced shear zones. One stock of quartz-porphyry, known as the Pearl Lake mass, is 5,000 feet long and 1,400 feet wide and it is around this that most of the veins are found in the lode system of the Hollinger-McIntyre area. Stopes have been carried half a mile along certain connecting veins at the Hollinger. At the Dome mine the ore deposits are more lens-like in shape, 15 to 150 feet wide, up to 600 feet in length and 800 feet in depth. In fact, the ore may be likened to plums in a pudding. The great irregularity of these ore shoots has made mining a difficult problem for both the mine geologist and mine manager. Faulting in ore bodies is not so marked as might be expected in such ancient rocks, movements usually taking place over a few feet only.

Gold at Kirkland Lake was discovered in 1912. Next to Porcupine, this is the most important gold area so far discovered in Ontario. Here the main fracture is distinctly marked and has been productive from the Kirkland Lake mine on the west to the Tough-Oakes Burnside on the east, a distance of 2¼ miles. Lying in between from west to east are the Teck-Hughes, Lake Shore, Wright-Hargreaves and Sylvanite mines, the latter not having reached the point of production as yet. At Kirkland an assemblage of intrusive rocks, (porphyries, syenites and lamprophyres in the

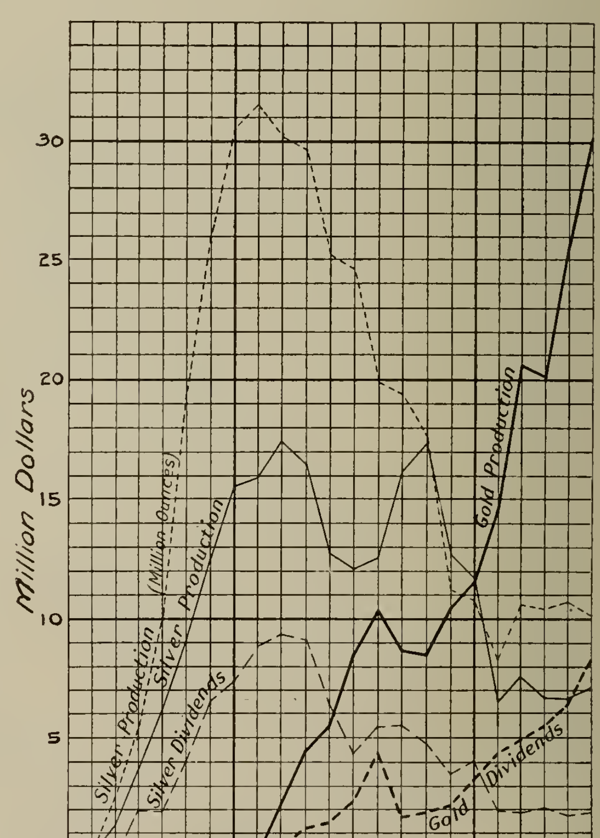

Figure No. 4.—Graph Showing Silver and Gold Production, and Dividends from Ontario's Mines since the Discovery of Silver at Cobalt in 1903.

form of stocks and dykes), have cut the Temiskaming sediments. Much faulting occurs along this ore zone, and through the fractures gold-bearing solutions were deposited. Subsequent faulting also has taken place. The fault walls of the main fracture are from a few feet to 40 feet apart, and ore is found near one or other of the walls or across the whole zone. In places the porphyry or syenite gangue is much brecciated and the ore, apart from the quartz, is reddish in colour as distinct from the Porcupine ores, which are generally of a greyish-black colour. Kirkland ore is rich in tellurides, some of them gold bearing, but the most common is altaite or lead telluride.

To show the average grade of ore at present being mined, production figures for the first nine months of 1926 show values of $14.53 per ton for Kirkland Lake and $7.66 for Porcupine, where larger tonnages are milled. The gross output for the same period was 18 million dollars for Porcupine and over 5 millions for Kirkland Lake.

General Geological Conditions

Canada has one distinct physiographical and geological feature which, coupled with its location in northern latitudes, has had a profound effect on the development of the country. The Laurentian Highland, Archean Protaxis or pre-Cambrian Shield, as it has been variously called, covers an immense U-shaped region surrounding Hudson and James bays and occupying over half of the entire area of the Dominion. It is made up of the most ancient rocks in the world. These have been glaciated for the most part and are covered with only a thin mantle of soil. The south boundary of this famous belt extends south of lake Superior, embracing the northern parts of Minnesota, Wisconsin and Michigan, and then cuts across Ontario from Penetanguishene to Gananoque, where a narrow neck crosses into New York state. Hudson and James bays form the centre of the letter " U," and on the southwest side there is a basin of Paleozoic (sedimentary) rocks similar in age to those underlying southern Ontario. Canada possesses the largest pre-Cambrian areas on the North American continent. Similar rocks occur in volume in Africa, South America, Australia and India, and have been productive of gold, but for the most part in these countries the pre-Cambrian is located in tropical or semi-tropical regions. Reference to the accompanying sketch maps, (figures Nos. 2 and 3), of pre-Cambrian regions will indicate the widespread occurrence of these rocks in Ontario,—in fact, 70 per cent of the province's area is so classified.

Ontario's vast pre-Cambrian area, larger than India, has been a barrier separating east from west, dividing Canada's agricultural communities and necessitating the construction of expensive transcontinental railway systems to cement Canada politically. Many have looked upon this region of comparatively low relief, not exceeding an altitude of 2,000 feet in Ontario, as an immense waste land. It is lake-studded and has an imperfect drainage system. Few have realized until recent years that it contains " vast stores of mineral wealth," as stated by Sir William Logan, the first director of the Geological Survey of Canada. Water powers are numerous for the development of forest and mineral resources.

Before passing on to a discussion of mineral resources, it should be mentioned that the pre-Cambrian contains many small isolated but fertile agricultural areas. In addition, one large region, known as the " clay-belt," in northeastern Ontario and northwestern Quebec, is traversed by the National Transcontinental Railway, and is estimated to occupy 20,000 square miles in Ontario, an area equal to half the agricultural section of southern Ontario. The fertile soil of the " clay-belt " is due to silt deposition in the basin of glacial lake Ojibway during the period when the northward retreating ice sheet blocked drainage in that direction. This " clay-belt " in the same latitude as the international boundary west of Lake of the Woods is proving to be excellent agricultural land as it is gradually cleared and cultivated, and the products are finding a market in adjacent mining centres.

Hydro-Electric Power

In the early stages of new mining developments, wood is the usual fuel supply. Of late years, Diesel oil-burning engines have been much used until such time as development warrants hydro-electric power. Nickel companies in the Sudbury area have power plants with turbine capacity as follows:—International, 21,700, and Mond, 11,800 horse power. Nickel-copper, gold and silver mines of northern Ontario are using about 83,000 horse power, divided as follows:—Nickel-copper 28,850 h.p., gold 46,350 h.p., and silver 7,800 h.p., all of this coming from Ontario power plants except that from the Quinze development of 10,000 horse power,—the first of four units. The total turbine capacity of Ontario plants is 112,720 horse power.

Deep Mine Workings

With the completion of the McIntyre 4,000-foot shaft in March, metal mining in Ontario will have reached its greatest depth to date. The Hollinger sub-shaft has been sunk to 3,151 feet. In the Sudbury area the Frood Extension, (Mond Nickel Co.), has reached a depth of 2,030 feet, and at the Frood the International Nickel Company of Canada expects to sink to 2,300 feet. The Kirkland Lake mine shaft is 2,265 feet deep. In South Africa " rock bursts " and earth tremors have been experienced at depths of 3,000 feet and greater. The " Village Deep " mine in the Transvaal is 6,980 feet deep and the rock temperature at the bottom is 94°F. Fortunately no high temperature problem exists in Ontario, but we are now confronted with problems peculiar to deep mining, and the McIntyre mine has announced a change from " shrinkage " stoping to the " cut and fill " method as standard practice on the new levels. The Hollinger is using sand for back filling stopes below the 2,000-foot level.

Wealth of the Pre-Cambrian

Ontario, it has been pointed out, possesses immense pre-Cambrian regions. What follows will demonstrate that within the pre-Cambrian certain geological sub-divisions are favourable for the occurrence of economic minerals, metals in particular. The world-famous copper mines of the Keweenaw peninsula, which juts north into lake Superior, have been regularly worked for 80 years and in normal years produce 100,000 tons of copper. These noted copper deposits on the south side of lake Superior occur in pre-Cambrian rocks, as do also the iron deposits of northern Michigan, Wisconsin and Minnesota. This " lake " region has produced enormous tonnages of iron ore. Last year some 60,000,000 tons of " lake " ore were shipped, by boat for the most part, chiefly to iron centres of the United States. Large reserves, estimated at 70,000 million tons, still lie untouched. Although high-grade ore is diminishing, the technical problem of beneficiation is meeting with success, and lower-grade ores will be used in larger volume in future than at present. As that day approaches, Ontario's siliceous ores,—magnetites and siderites,—will be utilized. During the past year, not a ton of Ontario iron ore has been mined or charged to Ontario blast furnaces. Ontario's iron deposits are extensive and will prove valuable ultimately.

Sudbury, Cobalt and Porcupine, all situated within the pre-Cambrian, have poured out their wealth of nickel-copper, silver-cobalt and gold. Sudbury has in reserve more than 100 million tons of ore, enough to last seventy-five years at the present rate of production. Although silver output from Cobalt is declining the life of the camp has been long (24 years) as mining camps go, and outlying areas, such as South Lorrain and Gowganda, are coming to the fore. Production from Porcupine, Kirkland Lake and lesser camps has placed Ontario in third position among the gold-producing countries of the world, exceeded only by South Africa and the United States, and the prospects for overtaking the United States before 1930 are good.

The following table presents the value of output in 1925 and also the total to the end of 1925 for the three major metal mining industries of the province:—

ONTARIO METAL PRODUCTION AND DIVIDENDS

Industry	1925	Total to end of 1925		
		Value	Dividends	Per Cent
Nickel-Copper.	$22,361,551	$296,631,764	....	....
Silver-Cobalt...	9,312,100	244,758,432	$ 91,951,725	37.9
Gold..........	30,206,432	184,492,033	48,338,005	26.2
Others........	616,389	97,170,367	....	....
Total......	$62,495,472	$823,052,596	....	....

Incidentally it may be mentioned that Ontario in 1925 passed the Yukon in the gross output of gold. Maximum production in the Yukon was in 1900 when gold to the value of $22,275,000 was produced.

Ontario's mineral production in 1925, the last year for which statistics are complete, was $87,583,306. Of this total, $62,495,472 was credited to metals, $7,488,034 to non-metallic minerals, $12,451,174 to construction materials and $5,148,626 to clay products. Employees numbering 20,409 received $24,836,744 in wages. The nationality of men employed by twenty-seven metal mining companies of Ontario as of February 1st, 1923,—the officers of all these being members of the Ontario Mining Association,—shows that out of 7,317 employees, 39 per cent were Canadians, 25 per cent from the British Isles, 11 per cent Italians, 6 per cent Finnish, 5 per cent Poles, 4 per cent Austrians, 3 per cent Slavs, 2 per cent American, 2 per cent Roumanian and 3 per cent from other countries. Speaking roughly, it may be stated that two-thirds the value of our mineral production is expended in wages, equipment and supplies of all kinds, and eventually filters down to all classes of society. Dividends go to the investor and in turn are expended in the same way or are re-invested in new enterprises.

Northern Ontario undoubtedly has before her a bright future. Metals are widespread and segregations in centres other than those where profitable operation already has taken place will be discovered. Large virgin areas, particularly in Patricia district, still remain to be prospected. Most of the economic areas so far discovered have been mapped by geologists of either the Ontario Department of Mines or the Geological Survey of Canada, but pre-Cambrian geology is so complex that many years must elapse before detailed maps of the whole can be prepared. This leads us to a conclusion of human interest, namely, that our mineral wealth in the pre-Cambrian offers great inducements for red-blooded young men of our generation to turn their faces north rather than south and devote their energies to the development of our yet undiscovered mineral resources. The miner is a pathfinder, paving the way for development of other branches of industry.

Notes on the Forests of Quebec

A Review of Problems of Forest Administration

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Paper to be presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

Having had occasion to deal, somewhat at length, with the question of our forest resources at your annual meeting, held in Montreal in 1920, it is not intended in this paper to cover exactly the same ground, but rather to make a summary of our situation and of our methods of administration, and to answer some of the questions raised by an article on "The Need of a Forest Policy" which appeared in the January issue of "The Engineering Journal."

First, the writer wishes to say that he agrees with the statement in that article to the effect that every engineer should keep in close touch with the forest policy of our country. In the past, this was not so evident as it is to-day, but as the industrialization of our forest products is becoming more and more intense, as the difficulties of transportation from our forests increase on account of the distance and of other factors, it is necessary to employ more efficient means and more mechanical devices than heretofore.

The necessity of making rapidly the reconnaissance of our northern territories has compelled us to employ aeroplanes. The wireless telegraph and telephone are now used for the protection of our forests and to improve means of communication with the remote sections of our province.

The enormous hydraulic development which is now taking place in Canada, and especially in this province, through the harnessing of our waterfalls, the power being stabilized by the construction of huge storage dams, has also a direct connection with the protection of the forest cover of these watersheds, as it regulates the flow of the streams.

It is obvious that engineers are deeply interested in a national forest policy. It is also natural that a certain group of young men, finding a new field of activity in the treatment of our forests, in the handling of our lumbering problems and of the methods of utilizing forest products, have begun to specialize in the studies required for this important task. Forest engineers should form part of The Institute, and they desire that those working in other fields of engineering should support them in the work which they have at heart.

Extent of Forest Resources

On account of the gradual opening up of colonization areas, of the building of large and small towns and of villages, and also owing to disastrous fires and lumbering methods, the forest resources of this country, as well as those of other countries of the world, have been greatly diminished to a point such that many people are wondering whether the remainder is really in a safe position to supply us with the amount of timber which is now removed every year from them. Although the timber situation is generally bad, there are a few countries like Canada, Sweden and Russia which are still in a position to produce enough timber to meet their legitimate requirements, and also to export a certain quantity for their neighbours in dire need.

It must not be forgotten that Canada still possesses over 700,000,000 acres of timberlands, (see Appendix Note No. 1), and that the province of Quebec controls for her share about 130,000,000 acres of territory which may produce, in the course of a sylvicultural rotation varying from 80 to 150 years, wood-goods that can be used with profit by the trade or the industry.

Some people forget that the cut-over lands, and even the burnt-over sectors, will yield eventually a new crop of timber if they do not suffer repeated damages from other fires. In fact, we are now cutting pulpwood in some sectors of the lake St. John district where the fire of 1870 had completely destroyed the forest, and the same is true with other sectors of the province. But it must be admitted that, in too many cases, where fires have followed fires the result has been that the bare rock is the only thing left, and in such places one cannot expect a merchantable crop until several centuries have passed. One must not forget also that we have in Old Quebec an area of 225,000,000 acres and as many acres in New Quebec. Therefore, when the statement is made that our merchantable forests cover less than 30 per cent of all the territories in this province, which runs from the 45th parallel north to the 62nd and which extends from the 56th degree of longitude west to the 79th, the writer claims that the estimate is moderate. But, in order to avoid being misquoted or misunderstood, the writer wishes you to realize that the whole of this area of 130,000,000 acres is not fully covered with forests that could be cut immediately, but contains a succession of age classes which assure us of a continuous timber production, *provided this immense domain is duly protected against fires and that it is properly improved by the sylvicultural methods advocated by foresters.*

Ownership of the Forests

Thanks to the foresight of our predecessors, the government of this province still remains proprietor of the bulk of our forest wealth, as not more than 5 per cent is held in fee simple.

The private forests, covering about 7,000,000 acres, are found within our old seigniories and in the territories granted as railway subsidies; in the same group we include the numerous woodlots of farmers and settlers.

The so-called timber limits are forests leased at public auction from time to time by the government, after several notices in the Official Gazette. These timber limits are not sold, but simply leased to the lumbermen for a period of twelve months. The lease contract, which is called license or lumbering permit, can be renewed on the first of May of every year, provided the limit holder has duly observed the law and regulations. Presently, more than 50,000,000 acres in the province of Quebec are thus held under license to cut. These timber limits extend in the St. Lawrence watershed from the boundaries of our villages to the Height of Land. The major part of the Ottawa valley and of the

St. Maurice watersheds and a good proportion of the lake St. John and Saguenay districts are under license to cut. On the south shore of the St. Lawrence, only 30 per cent of the land is in timber limits, the rest being occupied by farmers and private forests.

The great reserves of the Crown, that is, the vacant forest lands, are situated partly in the upper lake St. John district, partly in the Saguenay country, between Bersimis and Blanc-Sablon, and the balance is found in the basins of James bay and of the Hamilton river. Thus, the leased forests comprise the bulk of the accessible forest lands, whereas most of vacant Crown forests are located outside of present means of communication, except for Saguenay county, where conditions are improving very fast and where much activity is to be expected in a near future.

Therefore, in calculating to what extent we can allow our licensees to cut, we cannot and do not yet take into account the forests of James bay, of Hamilton river or other sections of New Quebec, but must and do base our calculations exclusively on the actual resources of the St. Lawrence watershed.

Timber License Requirements

You will be interested to learn what our limit holders are required to do, remembering that the provincial government is often accused of favouring unduly the influential and wealthy lumberman. Each limit holder, in order to obtain the right to cut, has to pay immediately, if he is the successful bidder at auction, a certain amount per square mile, called the "*bonus of adjudication.*"

Every year he is required to pay a rental fixed, until 1930, at $8.00 per square mile. This *ground rent* alone produces a revenue of more than $600,000 a year. The limit holder is also compelled to defray all the expenses of preventing forest fires, trespassers, etc., which means an annual expense of about $10.00 per square mile.

When he cuts timber on his limits, he must then pay royalty or *stumpage dues* on every log made. Stumpage dues are liable to change from time to time. Until 1910, they were only 65 cents per thousand feet B.M. for spruce, but since 1920 they have been increased to $2.70. The Hon. Mr. Taschereau has refused to fix them for any definite period, reserving the liberty to adjust the royalties according to conditions of the market. Should the lumber trade or the pulp and paper business flourish, the government wishes to get its legitimate share during any such prosperous period by increasing the royalty; but should there come a commercial depression, the government is also willing to adjust dues accordingly. Stumpage dues now give us a revenue of about $3,000,000 a year.

The government has allowed timber licenses to be given as collateral security for loans made by banks to our lumbermen. These titles can also be sold or exchanged, but in each case a transfer premium of $20.00 per square mile is exacted, so that again we may share a little in the profits obtained through these transactions.

All these sources of income enable us to transmit to the treasurer of the province about $5,000,000 per year. Since Confederation, our timber limits have given a total revenue of $71,341,435.96; more than a half of this large amount has been collected since 1910, when Sir Lomer Gouin inaugurated important changes in our stumpage rates, in the amounts imposed for ground rent, etc.

This annual income of $5,000,000 may appear substantial, but it is small compared to what our forests will give us in the future, *provided we take the means to protect and improve them efficiently.*

Improvement in Forest Protection

In connection with the possibilities of utilizing our forest resources, let us consider what has taken place in Sweden, a country where conditions of the forest, of the soil, of climate and of the species are not altogether as good as ours.

The area of the Swedish forests is almost equivalent to that now under license in this province. (See Appendix Note No. 2.) Yet Sweden draws from her forests one and one-half billion cubic feet per annum, whereas the present production of our Quebec timber limits is only one-fourth of that quantity. It is true that the area of burnt-over tracts in Sweden is insignificant compared to the millions of acres which have been devastated here by fires until recent years, but we can hope to do as well as the Swedes are now doing if we follow their example. Fifty years ago they had fires as bad and as numerous as we have had here until late, but they did not hesitate to entrust the full management of their forests to engineers, with the result that to-day the Swedish forests are greatly improved, and they are now really fireproof, so much so that they do not now spend one-twentieth of the sum we have to disburse every year for fire protection.

The progress made here during the last two decades enables us to hope that we may, before long, reach the same stage as our competitors. In less than ten years the protection of our forests has been so improved that during the last three years the damages suffered therefrom have been very small. Public opinion is now so interested in our forest policy that the government is fully supported whenever energetic laws and measures have to be imposed to safeguard or improve our forests. Allow me to recall also that from the Forest School, opened in Quebec in 1910, seventy-two engineers have graduated up to this date.

Four years ago a Rangers' School was established at Berthierville, and already two classes, of twenty men each, have received their diplomas, and every one of these is working either for a company or for the government.

Forest Inventories

Though it was only in 1922 that the law of Forest Inventories was passed by Hon. Mr. Mercier, we have now over 11,000 square miles, or about one-seventh of the total area of our leased forests, inventoried, and, further, working plans have been passed and approved for these areas by the Lieutenant-Governor-in-Council. A quantity of timber,—which we consider equal to the annual increment of these forests,—is set as the maximum yield which the limit holder can cut thereon every year. Before allowing the licensee to operate, an inspection is made by officers of the Forest Service in order to decide upon the best methods of treatment to be employed so as to insure the proper regeneration of the forest. Therefore, on these 11,000 square miles of timber limits the yearly cut is virtually limited to the annual growth of the forest.

You will be agreeably surprised to learn that on these 11,000 square miles there were found 45,000,000 cords of softwoods, and this, though this group which comprises cut-over lands, burned-over tracts and virgin forests, was not specially selected. In fact, it includes limits from every part of the province. While not in position to affirm that this is an exact average of our present forest conditions, yet if it were, and the chances are it may be so, there would be left at least 300,000,000 cords of pulpwood within the areas under license, and it would mean that we could draw six million cords every year from our timber limits alone. This would be very encouraging. Therefore, it is essential that the forest inventories of all timber limits, as well as of a good part of our vacant Crown lands, should be carried on energetically. In fact, we expect that by 1930 all the timber limits will have been inventoried and the same work on unallotted Crown lands and township reserves will not be far behind.

The thing which may delay forest inventories is the difficulty of making definite land classification. In many places it is possible to create immediately permanent forest reserves, but in several regions the question presents numerous difficulties and it requires a succession of adjustments before being finally decided.

The question has also been raised about the encroachments of settlers on our public domain. Without any doubt, many errors have thus been made in the past and many other errors will still be made hereafter, but this is human, and, furthermore, it must be expected in the building up of such an enormous country as ours. However, the writer feels confident that these errors will never be duplicated on a large scale, as our people now realize the necessity of making permanent reserves to supply the needs of large wood-working establishments. For example, a seventy-five year reserve was created last year for the benefit of the Singer Manufacturing Company, who wanted this guarantee before building, at Thurso, a huge furniture plant. This mill, employing hundreds of men, will certainly bring to that region far greater advantages than could be derived from a few settlers toiling on lots of doubtful character located in isolated places, and thus deprived of chances to make a success, notwithstanding their great efforts.

Several similar permanent reserves could be established with advantage, but it would not be a good policy to organize these reserves in favour of any lumbering company without exacting as a compensation the quick completion of their forest inventories and the building of adequate wood-working plants to finish the products here.

The important progress made during the last decade in the prevention and fighting of forest fires through the organization of efficient protective services by the government and among limit holders and through an active and incessant propaganda has already been mentioned. The results obtained are really encouraging, but we must not stop there. The problem of forest débris is yet an important one to solve. Active and complete patrolling of our forests must be maintained, notwithstanding the apparent reduction in danger. The government control of the burning of clearings on settlers' lots has indeed brought much relief and satisfaction but this burning is such a great cause of fires that it must always be followed closely. Railways have improved wonderfully their control of bush fires along their rights-of-way, so much so that they now cause but little damage. The travel permit system has been a real blessing, as it has forced the various travellers in our woods, such as fishermen, hunters, etc., to become more careful with their fires. Five years have elapsed since the big mining boom started in the Rouyn district, and yet no big fire has occurred there since 1923; this shows that co-operation between prospectors, miners and protective organizations has not been inoperative. Much work remains to be done, but it is being accomplished as fast as possible. The quicker our forests are being made fireproof the greater hopes can we place upon them.

Reduction of Logging Waste

Coming now to the question of reducing waste in logging operations, it is found that in that field much progress has also been made during the last twenty years. In several pulpwood operations we are now cutting stumps as low as one foot above the ground, tops are reduced to two or three inches; fire-killed timber as well as insect-killed or blown-down material are removed as promptly and completely as possible. Hardwoods, which formerly were not utilized on our limits, are now being exploited to a greater degree every year. This is welcome, as it allows more room for the reproduction of softwoods and it increases the productivity of our woodlands. It may be necessary to build and operate railways to reach inaccessible stands in order to remove a larger proportion of the stock per acre; these reforms are to be expected, but they will become more general as the market conditions improve. For example, when newsprint was selling for $32 per ton, we could not expect or compel our lumbermen to practice sylviculture or to adopt lumbering methods similar to those which they themselves have introduced now that their product is selling at $65. Should paper reach $100 per ton, we might expect and should exact from them a more intense application of forestry.

Our forest policy should not neglect the various means of increasing the productivity of our forests, and this requires extensive researches in the field. As these studies must be conducted by expert foresters, a bureau of forest research will very soon be organized to handle this very important work, in co-operation with the owners and lessees of forest lands.

Reforestation will also be very beneficial in the oldest sectors of this province. In the Eastern Townships alone, there are close to one million acres of waste lands which, if planted, could produce every year enough timber to meet the requirements of two big pulp and paper mills. Should the natural means of regeneration be found insufficient to bring back some of our forests to normal condition, it will be advisable to complete the stand by planting good trees.

A sound forest policy is one that aims to utilize all possible forest products with the maximum of advantage to all interested. In Sweden, for example, in the majority of operations, we find that the débris of logging, such as tops, refuse, etc., are converted into charcoal, but they do this only where it pays to do so. When this operation is not profitable, they simply leave their tops and other débris on the ground, just as we do now.

Therefore, close to manufacturing establishments, to railways, to waterways, you can practice better forestry than in the remote sections where there is no facility to remove all the products. In other words, forestry follows closely the development of a country and is dependable on adequate markets.

Present State of Our Lumber Industry

During the French régime our lumber industry assumed no great importance, as it only consisted in the export of small quantities of deals, boards, masts and spars to French ports and in the supply of oak timber for the few ships built in the vicinity of Quebec city. It was only during the Continental Blockade that England began to draw upon her colony of North America for the lumber which she could not obtain, as before, from the Continent. Our export business rapidly became considerable and the wooden ship industry meant much to us, as more than 2,500 wooden ships were built in this country between 1797 and 1880. About 1840, the depletion of the American forests in the New England states enabled us also to export lumber to our neighbours, and this new field soon acquired great importance, and it still remains our best export market.

About 1895 the first large pulpwood operations began to supply our mills and those of the United States. The growth of this industry, which is now by far the most important of Canada, having even eclipsed that of flour, has been very remarkable in the last twenty years. Pulpmills are mentioned for the first time in the census of 1881, although there was one established at Windsor Mills about 1870. In 1925 there were 114 pulp and paper mills in Canada; the capitalization of the industry being $460,397,-772 and the total value of their manufactured products $240,896,560. The total quantity of pulpwood produced in that year was 5,092,461 cords, of which 3,668,959 cords were manufactured in Canada and 1,423,502 were exported. This question is being covered in another paper, but it is interesting to note that to-day the pulp and paper industry has almost displaced and replaced the lumber industry in eastern Canada. Except where pine, hemlock or hardwoods can be manufactured into lumber, our large sawmills are closing down one after the other. Pulp and paper manufacturers acquire each year more and more of the pulpwood timber limits, so much so that in Quebec 75 per cent of our timber limits are now controlled by this industry.

This transformation should not be regretted, because the pulp and paper industry is a very stable and interesting one. So much capital is invested in it that the industrials naturally take a greater interest in the preservation of the forests than the majority of the old lumbermen, who considered their industry as being of a more transient character. Pulp and paper companies are all disposed to employ foresters, to organize systematic lumbering and to place their forests under intensive management. It must not be thought that the writer has no word of praise for the old lumbermen, for it is impossible to forget what they have done for this country, how they led our pioneers to open up our remote districts, how they supported new settlements, how they fought battles royal to dispose of their products in the markets of England and the United States. A great debt is owing to them, but it cannot be helped that a new industry has replaced theirs, and that sawmills will only thrive in rural districts to take care of the local trade.

The instances already mentioned regarding the protection and utilization of our forests are the concern of the forest engineer, lumberman and manufacturer, but it should be noted that chemical, mechanical and electrical engineers are also occupied with this subject and are developing new lines of investigation, the results of which will aid in economy by utilizing the waste products from wood and by opening up new avenues of usefulness. There is space only for one or two illustrations of this department of progress.

New discoveries made in late years in France have shown that gas from charcoal may replace gasoline for internal combustion engines, and that wood gas may be used for the propulsion of autos, tractors and other vehicles. Should this process be developed for general use, it will mean very much to us, as it will allow the cleaning of the forest floor, thus minimizing the danger of fire and also permitting us to use more of the hardwoods, which, as you know, produce better charcoal than softwoods.

Among the by-products which wood may furnish through distillation may be named wood alcohol, turpentine, lampblack, acetate of lime, wood gas, wood tar, etc., and also the potash and pearlash which were produced in the old days by washing the ashes of hardwoods. From sawdust one can obtain either oxalic acid or glucose, the last will, if fermented, produce ethyl alcohol or real sugar. It is also claimed that one can extract from the rosin of wood or from the needles of spruce various products which can be transformed into artificial camphor.

To-day there is being manufactured a new chemical pulp called *alpha pulp,* which contains almost 100 per cent of fibre, which is equal to, if not better than, that of cotton and which is used for conversion into rayon or artificial silk. Therefore, the products which wood may give under chemical treatment are almost unlimited, and one feels sure that the by-products which can be produced or recovered from the mill's wastes have also a very promising future.

All this shows that it is possible in the near future, by the co-operation of all those who have an interest in the welfare of our forests, to obtain a larger number of products and by-products than before, and the more useful and remunerative our forest products become the more it will be possible to give to our forests an intensive treatment which will increase their value to the community.

APPENDIX

Note No. 1

The total area covered by existing forests in Canada has been estimated at approximately 1,227,000 square miles. The estimated stand of timber of merchantable size, (disregarding present accessibility), is approximately 482,075,500,000 feet board measure for saw timber and 1,279,705,000 cords of pulpwood, cordwood and other merchantable products. Of the total for saw timber, 72 per cent is located in British Columbia; 22 per cent in the eastern provinces, and about 6 per cent in the prairie provinces. About 91 per cent of hardwoods being found chiefly in the eastern provinces. The total for merchantable material of all kinds has been estimated at 246,826 million cubic feet.

Lumber Industry in 1924.
Bulletin, Statistics Bureau.

Note No. 2

The productive forests of Sweden are estimated at 55,000,000 acres, of which public or state forests constitute 13,000,000 acres and private forests 42,000,000 acres.

(A. Oxholm—" Swedish Forests.")
Bulletin, Dept. of Commerce.

Woodlands Management and Operation

The Conditions Governing Forest Development with Exploitation

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Paper to be presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

About one-quarter of the total area of Canada, or 950,000 square miles, is forest area, of which 460,000 square miles carries timber of merchantable size.

In 1924 the total estimated stand of timber of merchantable size was placed at 246 billion cubic feet. Of this amount, over 80 per cent, or 198 billion cubic feet, consists of the softwood species, from which comes 95 per cent of our sawn lumber production and practically 100 per cent of our pulpwood production.

Canada's forest industries are second only to agriculture in value of production. In 1923 our wood and paper products had a gross value of over $550,000,000.

Our principal forest products are lumber, pulpwood, ties, poles, firewood and various minor products and biproducts.

Methods of forest operation vary materially in different parts of the Dominion.

In the east, climatic conditions limit cutting and hauling largely to the fall and winter months. Cutting is commenced in the late summer or early fall and continues until the snow becomes too deep for cutting and skidding. Logs are assembled in skidways and pulpwood in piles, near the point of felling, and are hauled on snow and iced roads with horses or tractors to adjacent drivable streams during the winter, to be driven to the mills or shipping points on the flood water of the following spring.

In the west, operations are carried on in most cases throughout the entire year. There logs are assembled by slides and various cable systems, while logging railways are used extensively to carry the timber direct to the mills or to the larger rivers, or to tide water, from whence it is towed to the mills.

Past and Present Attitudes in Regard to Forest Operations

The increasing consumption of forest products, accompanied by lessening supplies and enhanced values of standing timber, as well as higher operating costs, have resulted in an entirely different attitude towards the treatment of the forest in recent years.

Not very long ago it was the general custom to instruct the woods boss to cut a certain number of logs in a specified region, and if he got the requisite quantity at a seemingly reasonable cost the operation was considered a success.

No attention was paid to the fact that only the best of the timber adjacent to the streams was being cut; that more mature timber was being left to decay or blow down than was taken; that waste in high stumps and large tops was equivalent to a considerable percentage of timber actually utilized; and that the future cost of cutting the merchantable timber then left would be all out of proportion with reasonable logging costs.

However, before censuring the policy then followed, consideration should be given to the business conditions which existed previously. What is commercially profitable to-day was not so then. Twenty years ago there was no profit in logs produced for lumber, unless they were large, clear and entirely sound. To-day logs 3 inches in diameter at the small end can be used to advantage in the manufacture of pulp and paper, and those containing a considerable amount of rot can also be utilized in some classes of pulp.

A few years ago spruce was considered the only species from which really good pulp could be made; balsam was frowned upon for various reasons and the mills tried to limit the quantity used to a low percentage. In consequence, operators restricted their cut in the forest to spruce as much as possible, and the greater part of the merchantable balsam was left standing and allowed to become a total loss. At the same time this less desirable species, being more prolific than the spruce, soon seeded in large areas, with the result that almost pure stands of balsam now replace the previously mixed stands of greater value. Some pulp and paper makers still object to high percentages of balsam, but it is no longer customary to discriminate against it to any great extent in present-day logging operations.

As a result of the changed conditions previously referred to, the wood-using industries now appreciate that their forest capital merits as much care and attention as their other invested capital. They are fully aware of the limitations of supply and are actively engaged in providing for the future through operating plans based on sustained yield, improved logging methods, closer utilization, more efficient forest production and by further acquisitions of timber lands.

They realize that while utilizing the present merchantable material in the forest they must at the same time provide for the continuance of the forest and for the production of timber in the future. They appreciate that the condition of the forest must be improved and its productivity increased, that waste must be eliminated, and that losses from decay, fungi, insects, windfall and fire must be prevented insofar as is humanly possible.

How the Desired Results May be Obtained

The attainment of these results calls for a detailed classification of the forest. This is the first requisite, for without it a rational cutting programme and suitable silvicultural system cannot be evolved.

Time does not permit going into extended details as to silvicultural systems. Briefly, the result desired is to secure quick reproduction of the more valuable species in fully-stocked stands; to produce trees of good form and quality and to accomplish rapid growth.

Quick reproduction is secured by careful cutting, avoiding injury to young growth as much as possible and by keeping out fire. Increase in quantity of desirable species is obtained by cutting the less desirable species to a lower diameter limit.

Fully-stocked stands are dependent on an abundant distribution of seed and conditions favourable to germination and early growth. Good form and quality are obtained in mixed rather than pure stands.

General Conditions Pertaining to Standing Timber in the East and Present-Day Methods of Handling

In the east the timber with which we have to deal may be divided into three general classes, viz.:—

Mature and over-mature stands of merchantable timber;

Immature stands containing stock of merchantable size; and

Areas of reproduction and young growth.

A very large portion of our timber falls into the first class. A small annual increment may be observed in individual trees, but this is often balanced by decay in others, and the stand as a whole may be either at a standstill or going backward. Our greatest problem, and the one which will take the most time, is to place such areas on a profitable producing basis.

It has been found that cutting such stands to a fixed diameter is useless and wasteful. There are many small trees which are as old as the largest in the stand, which, if left, will produce but little growth and may not survive until the next cutting period. In such stands clear cutting is resorted to, which involves the removal of all the merchantable timber in one operation.

To provide for sufficient natural reproduction where this does not already exist in the form of numerous seedlings and young growth, thrifty, full-crowned, wind-firm seed trees are left. For this purpose small trees are as satisfactory as large trees, provided they are thrifty and full-crowned, and many of those which are left because they are not of merchantable size fulfill this purpose.

Immature stands containing stock of merchantable size constitute our second line of defence in regard to future supply, and should not be cut into beyond what is necessary to improve their condition and to stimulate maximum production of merchantable wood of high quality. Selective cuttings are applicable to these growing stands where the trees are wind-firm, and where the volume of merchantable timber per acre is sufficient to permit a partial cut on an economic basis.

In actual practice certain diameter limits are adopted, but before a diameter limit can be successfully applied it is necessary to determine what the forest can produce and at what diameter further growth is no longer sufficiently profitable. Also, any particular diameter limit does not take into consideration the condition of trees as to health and growth. Defective trees should be removed, while others above the diameter limit may be making such rapid growth that it is good policy to leave them. Then again, it is sometimes necessary to cut whole groups of trees under the diameter limit to save them from loss by windfall.

The advantages of selective cutting are several. A large number of seed trees, comparatively close together, are distributing seed at regular intervals. The shade of the standing trees retards the growth of brush, weeds and grass and the seedlings are protected from drying out and from frost. A new stand is established during the period in which the remaining old stand is gaining its maximum growth.

The third class, namely, areas of reproduction and young growth, are a fertile field for future efforts, but, in the meantime, if fire can be kept out of them, nature will go a long way in carrying them along until it is economically practical for us to attempt to improve their condition.

Woodlands Management and Operation in Eastern Canada

The Forest Inventory

It has been stated or inferred in the foregoing that a detailed classification of the forest is the first requisite for intelligent and successful operation of the forest. This classification, more familiarly known as a *forest inventory*, comprises:—

Maps, preferably topographic, showing natural features, such as the drainage system, with the drivable streams specially indicated, and watershed lines; distribution of timber by types, species, amount and size; existing improvements, such as roads, trails, camps, dams, etc.; subsequent changes in the forest, such as cuttings, burns, windfalls, etc.; division of the area into suitable logging units based on the natural features of the land; relation of the tract to other properties; means of access by railways, summer and winter roads and navigable waters.

Tabulations, showing classification of the total area.

Estimates of merchantable timber in total, and subdivided by watersheds and logging units and classified according to type, species, diameter and age.

Reports covering condition of timber, rate of growth and reproduction; aspects relative to operating; condition of existing improvements; further improvements, property and rights necessary for efficient operation; opportunity for co-operation with other companies in the vicinity; sources of danger from fire and necessary facilities for protection; suitability of land for agriculture if cleared; extent of operation possible, estimates of operating costs and carrying charges.

The General Working Plan

The forest inventory is the basis on which a *general working plan* is formulated, which, to be of real value, must be made for several years in advance in order that necessary improvements may be anticipated and constructed on a predetermined time schedule and to permit cutting operations to be regulated so that logs and pulpwood may be produced over a period at a uniform cost.

Working plans should be made for periods of from five to ten years in advance, subject, of course, to changes and modifications in detail from time to time as unforeseen conditions warrant. The ideal working plan aims at maximum production at a uniform cost over a period of years, with uniform expenditures from year to year for operating improvements rather than heavy capital additions at irregular intervals.

The forest inventory shows the distribution and amount of available timber in any watershed, and the cost of improvements necessary for its removal is figured and later written off on a cord or thousand-foot basis over the total amount of timber served during the useful life of the various improvements.

The maps and estimates show the amount of timber directly tributary to any particular stream, section of river or road, and improvements are extended gradually in advance of cutting requirements.

In formulating a working plan, after the quantity to be cut annually has been decided upon, the accessibility of the property from the operating viewpoint has to be considered. If winter roads are to be relied upon, it becomes necessary to put in sufficient provisions and supplies during one winter to carry the following season's operations along until snow hauling is again possible.

This method of operation has various disadvantages, among which are: initial cost and maintenance charges of large storehouses; working capital tied up in provisions and supplies for from eight to twelve months before they are used; interest, insurance and handling charges; losses from shrinkage and spoiling; inability to purchase at opportune times; poor means of communication and transportation during spring, summer and fall; attendant difficulties to obtain and transport labour because of inconvenience and time element involved; all contributing to the demand for higher prices by contractors.

A system of summer roads suitable for wagons, trucks or tractors permits transporting provisions and supplies as needed, thereby eliminating to a large extent many of the charges mentioned in the previous paragraph.

If the operations are at a considerable distance from the source of supply it may still be advantageous to put in the heavier supplies during the winter, but the greater the distances to be overcome the better the means of ingress and egress required, particularly from the standpoint of obtaining and keeping the necessary labour.

With summer roads, the current season's field crops can be utilized, fresh meat can be obtained as required, improvement crews can be moved about and handled with greater efficiency, and early cutting can be commenced when desired, with greater ease.

Improvements

A study of the maps and reports forming part of the forest inventory aids in locating the most suitable routes for main roads and sites for operating headquarters and storehouses in the woods.

Roads

Surveys are made for road locations previous to construction so that the best possible grades may be obtained, and are built in a manner permitting gradual improvement and reasonable maintenance charges in the future.

A good bottom, completely freed from stumps and roots, adequate drainage and sufficient clearing on either side to permit drying out by wind and sun are the primary requisites for a satisfactory woods road. Such a road may be rough in the beginning, but with reasonable annual expenditure for maintenance and improvement it can be made suitable for the use of light weight motor vehicles in a comparatively short space of time.

Camps and Storehouses

Headquarters and scalers' camps are constructed in central locations which will permit maximum supervision with the minimum amount of travel. Unless lumber is immediately available, such camps are built preferably of peeled logs.

Storehouses are located where they will serve the greatest territory economically for the longest time, and are designed to expedite the handling of supplies with the least amount of labour.

Driving Dams and Other River Improvements

Studies are made as to precipitation, run-off and available storage capacity before dams are built. They are then designed and constructed according to specifications and dimensions which provide for stability and safety under the most adverse conditions to be expected, and with facilities permitting operation and control of the water stored to the best advantage during the course of driving operations.

Driving dams of low heads of ten to twelve feet are built of round timbers, preferably sap peeled, and are most frequently of the rafter or self-loading type, the use of stone filling being limited to the " pockets " adjacent to the gate openings and to the reinforcing cribwork on the sides of the sluiceways. The upstream face is covered with two thicknesses of plank with broken joints, or with hewn poles caulked with moss or shingle rip. Brush mats are placed at the toe and the whole is covered with a bed of clay, gravel or earth for a considerable distance in front of the toe and well up the slope of the face.

Frequently it is necessary to construct wooden dams for heads in excess of fifteen feet, or it may be desired to provide for longer life than can be figured on in dams of the rafter type. In such cases, crib structures filled with stone are built. Timbers are hewn or sawn on two faces and the bark is removed from the balance. Sawing to uniform thicknessses is preferable, as labour in erection is then greatly lessened, fitting is reduced to a minimum and a much better job throughout is obtained than in the use of hewn or round timber. Also, with a small sawmill at the site for facing the main timbers, it is then easy to saw the necessary lumber for sheathing, sheet piling, lining, etc., and the time and expense of " chinking " and caulking is eliminated.

Other river improvements consist of side piers and abutments, removal of obstacles by blasting, removal of fallen trees, etc., in stream beds, clearing flowage areas through which wood is driven or in which wood is stored, shear and guide booms.

Flumes

There is no cheaper method of transporting softwoods than by floating, but the natural watercourses do not always suit requirements. They may not run in the desired directions or they may be too small or too rough to carry the necessary quantities. Under such conditions, flumes can frequently be used to advantage in diverting wood from one watershed into another and in increasing the output of a particular region over what could be carried by the streams in their natural condition.

Flumes may also be used to concentrate the output of several streams at one central point; also in loading vessels and cars.

Flumes have been used extensively in some of the western states for many years. Their use has been chiefly where stream transportation was not available and where topography rendered railway cosntruction costly. Such flumes have been built in lengths up to 65 miles, with grades varying from 5 to 18 per cent and curvature up to 20°.

In the east, flumes have come into more frequent use during recent years in connection with the development of some of the more inaccessible and difficult pulpwood properties, particularly for the purpose of transporting logs and pulpwood from one watershed to another and in bringing pulpwood to points where it can be loaded on board vessels and railway cars. These eastern flumes do not have the high grades of those referred to in the west; in fact, the low grades of some of the eastern flumes are rather worthy of note, viz., varying from 0.1 to 0.2 per cent and having a capacity of from 40 to 60 cords per hour.

Annual Logging Plans

Any cutting policy, to be a success, must, in its final analysis, show a commercial profit or at least a definite promise of one in the near future. In consequence, it must be elastic enough to conform to current conditions. When labour and supplies are reasonable in price, scattered and difficult timber may be made at a profit, but under reverse conditions easier timber must be taken in order to keep the cost of raw materials at a reasonable figure.

Operating Maps

Previous to the commencement of each logging season, operating maps are prepared, based on the general working plan, showing the boundaries of each logging unit which is to be cut, these units being further subdivided into suitable logging chances where necessary. These subdivisions are numbered on the maps and the estimated amount of timber thereon is also shown. These operating maps are accompanied by sheets showing the area of each subdivision, stand per acre, amount to be contracted, point of delivery, average length of haul, proposed contract price, totals and averages.

This information is obtained from the maps and estimates and from further travel of the territory, and is used as a basis of letting contracts. As the contracts are let, the contractors' names are inserted on the operating maps on the areas assigned, for future reference.

Contracts are not let for exact amounts, *but to remove all the timber covered by the specifications* of the contract, which may be *found on the areas assigned,* estimated at so many cords or thousand feet, *more or less.*

It is usually found that a contractor demands a much larger area than necessary to cut a specified amount. If such concessions are made the usual result is that the easiest and best timber is cut first, and, after the contracted amount is made, scattered bunches remain on the area for which a much higher price is demanded at some later date.

From the standpoint of economy in operation, it is therefore preferable that contracts be made for the removal of all the timber conforming to specifications from a certain area rather than for definite amounts.

Contracting Policies

Contracting policies vary materially in different places. Some companies give out their entire cuts to one or more main contractors, who in turn sub-let all or part to sub-contractors. Other companies let a sufficient number of comparatively small contracts direct to total their requirements.

Not infrequently the large main contracts include the building of roads and storehouses, making river improvements and driving the timber cut under the contract to some specified point of delivery.

From the standpoint of producing large quantities of logs and pulpwood, there are certain advantages in such an arrangement with a responsible contractor; he has his own organization and makes his own arrangements for provisions, supplies, labour, equipment, buildings and transportation, and the company avoids initial expenditures of time and money on these items to a large extent. Responsibility for production and delivery at a certain point is assumed by the contractor, and the company is freed from the details of same up to a certain point.

However, there are many uncontrollable variables which may affect the carrying-out of the transaction before it is completed. The contractor, in anticipating his costs, must necessarily make adequate allowances for risks assumed and contingencies, and in consequence his total charge per cord or per thousand feet is increased accordingly.

Furthermore, while the company may supervise his cutting operations closely, it is much more difficult to get the desired results from the standpoint of utilization and careful preparation of wood, etc., in dealing with the numerous sub-contractors of a large contractor than is the case where the various contractors are dealing directly with the company.

Adequate control of logging operations is easiest obtained where individual contracts are limited in amount to, say, from 2,000 to 5,000 cords.

Logging Contracts

Some of the more important items usually covered in a logging contract are the following:—

Description and boundaries of the territory assigned.

Species to be utilized and estimated quantity, more or less, of same on the area, according to cutting specifications and place of delivery.

Specifications as to how the timber is to be cut and prepared, i.e., trees to be saw-felled, all logs to be cut with the saw, at both ends, in specified lengths; all branches and knots to be entirely removed, all sound wood in the tree to be utilized up to a specified top diameter; specifications as to quality of wood which is acceptable.

Manner of delivery, such as wood to be delivered on the banks of the rivers or lakes at places specified, or, at the option of the company, on the ice; landings to be entirely cleared of brush, stumps, etc.; wood to be piled evenly; space to be left between piles to permit inspection and scaling; back end of piles not to exceed a certain distance from the river or lake.

Measurement to be made at place of delivery only, by scalers named by the company; scalers may refuse to measure wood which is not properly piled or wood which is piled on landings improperly cleared.

Miscellaneous Regulations: The throwing or leaving of branches, trees or other debris in the rivers or lakes is prohibited; dates for commencing and completing cutting as well as minimum weekly production; dates for commencing and completing hauling as well as minimum amount to be hauled weekly; camps to be built of the dimensions and according to plans furnished by the company and in locations approved by the company.

Penalties: Covering trees left which should have been cut; trees cut outside boundaries of territory assigned; high stumps and large tops; wood cut but not hauled.

Contract Price: Schedule of advances.

Control of Logging Operations

Forest inventories and working plans are made by forest engineers, and it is logical that they should supervise and control the forest operations.

After seeing that the cutting areas have been marked out on the ground to correspond to the season's operating maps, the forest engineer co-operates in placing the contractors, selecting sites for logging camps and in marking out the main hauling roads.

Inspection

With the commencement of cutting operations, inspectors follow the cutting crews and see that they work in accordance with the conditions of the logging contract, paying particular attention to utilization, the way the wood is made and the production of the various crews. In addition to seeing that waste does not occur in high stumps, large tops, lodged trees, etc., the more important phases of inspection are to prevent scattered cutting, to keep the contractor within his boundaries and to see that he has sufficient labour and equipment at all times to make and deliver all the wood on his territory according to schedule of minimum production mentioned in his contract.

The latter cannot be followed successfully unless frequent inspections are made, as well as weekly reports showing number of men and horses engaged on each job and their average production. Also, good work and a small percentage of waste cannot be expected unless sufficient men and equipment are gotten in early enough to complete cutting before the deep snow.

These inspections are continued throughout the logging season. The closest inspection is necessary at the start, when additional assistance is received from the scalers who are on the staff and who are later changed to their regular work of measuring at points of delivery when sufficient wood has been hauled to occupy their time.

Each inspection is reported on a loose leaf *field inspection sheet*, filled in as the inspection is made, a separate sheet being used for each contractor and sub-contractor. This report shows date inspection is made; number of merchantable trees and tops left; number of high stumps, trees felled with the axe, logs or bolts under-length or over-length, culls and infractions; general conduct of the operation; sanitary condition of camps; number of men cutting, hauling, on roads and other work; number of horses hauling and on other work.

During the course of their inspections the inspectors draw the attention of the cutting crews to faulty work and infractions, and usually a marked improvement results immediately. In cases where the cutting crews are not amenable to reason, the woods superintendent follows up the contractor and induces him to exercise closer supervision over the work of his employees in order that the results desired may be obtained.

As cutting progresses, estimates are made of the quantities cut and piled in the woods and same are recorded on loose leaf *field estimate sheets*, a separate sheet being used for each inspection and for each contractor and sub-contractor. Each pile is numbered to correspond with numbering on the estimate sheets, and, in the case of logs, their number and average diameter is recorded; in the case of pulpwood, the approximate dimensions of the piles are given and the estimated percentage of cull.

Progress Reports

These field inspection and field estimate sheets are compiled weekly into a *logging inspection and progress report*, which, in addition to giving a summary of the items mentioned above, shows: number of weeks in cutting season; cutting schedule per week; previous total cut; amount cut during week; total cut to date; previous surplus or deficit on schedule; week's surplus or deficit; total surplus or deficit.

Similarly in regard to the hauling, this weekly report shows: number of weeks in hauling season; hauling schedule per week; previous total hauled; amount hauled during week; total hauled to date; previous surplus or deficit on schedule; week's surplus or deficit; total surplus or deficit.

These logging inspection and progress reports, which are made weekly for each contractor, permit a frequent review of the operations. They show what parts of the work need the closest watching as to improper methods, insufficient crews and production below schedule. They also show quite accurately progress to date, and form the basis for computing amounts earned and advances due up to the time of scaling at points of delivery.

Scaling

It has been well said, as far as logging is concerned, that the scaler is the most important accountant on the job, for upon the accuracy of his figures the company is dependent in making proper payments and in computing production costs all down the line. In consequence, the uttermost care should be exercised in the choice and training of scalers, in systematizing their work and in checking their accuracy.

Rollways and piles are marked and numbered as scaled at place of final delivery, in such a manner as to permit identification of any particular pile for the purpose of check scaling. It is a simple matter to scale straight, sound logs, but where defects occur, haphazard deductions usually result in loss to the company. A definite schedule of deductions for defects should be used and track kept of the deductions made. Similarly, losses occur in the measuring of pulpwood where proper allowances are not made for rot, knots, loose piling, short sticks, etc.

Where wood is driven it is difficult to check the amounts made in the woods by measurements at the mills because of the quantities left back on the drive each year and driven during following seasons with other cuts. In such cases, shortages are not detected until a clean-up is made on the river, which usually occurs only once every few years, and then it frequently becomes necessary to write off large amounts to profit and loss. It is safe to say that a large part of the losses attributed to sinkage in driving is actually due to improper and loose scaling methods in the woods.

Where large quantities of wood are being made it is a paying proposition to have a *scaling inspector*, whose duties comprise checking the methods and measurements of both the regular scalers and check scalers. This scaling inspector should be engaged by and report directly to the manager or some other executive outside the actual logging organization, and should be supplied with an adequate staff to carry out his work. This constitutes an *outside audit* of the scaling done by the logging organization.

Measurements made at points of delivery form the basis of settlement with the contractor for wood delivered, and in consequence each group of logs or pile of pulpwood scaled should be so marked and recorded that check measurements may be made and compared, for the company's satisfaction, and also to satisfy the contractor in cases of dispute.

All logs should be stamped as scaled and the piles numbered and marked with the date of the scale and the scaler's initials. Pulpwood piles should be similarly numbered, dated and initialled and all bolts stamped at the time of measurement.

Some contracts provide that the stamping be done by the contractor, but it is felt preferable that it be done by the scalers and their assistants at the time of measurement. It is then assumed that logs and pulpwood bearing stamp marks have been previously scaled. Also, where the company's employees do the stamping there is greater assurance that every piece will be clearly marked, which is of prime importance for future identification in later sorting operations during the drive.

The original scaling record is made on *field scale sheets*, which show the contractor's and sub-contractor's names, contract number, cutting area number, date, name of scaler and pile numbers. In the case of logs, they are tallied according to species, lengths and diameters, culls and cull deductions being recorded separately. In the case of pulpwood, the dimensions of each pile are recorded, and all deductions for rot, long sticks, short sticks, loose piling, knotty wood, etc., are listed separately under these various headings.

From these field scale sheets, *official scale slips* are made in triplicate in the woods office, for distribution as follows: one copy for the contractor, one for the accounting office, the third being retained in the scalers' office. Appropriate forms are used for check scalings and audit scalings, on which previous measurements can be listed for comparison, and for scaling summaries.

The transportation of logs on land and by water is being covered in a separate paper, so reference herein to those phases of logging operations will be limited to the following in respect to driving.

Driving

With adequate water supply and river improvements, successful driving then depends on the prompt and efficient handling of labour and water. The greatest aid in this connection is a telephone system along the streams being driven, with instruments at all dams and points where trouble may be anticipated.

Based on each year's experience, data should be compiled showing the periods of flood water on the various streams, the time required to fill dams, the time taken to draw them down with varied gate openings, the time required to drive various sections of the rivers and streams under normal conditions, time required to sluice known quantities of wood through dams and slides, driving capacity of streams, height of water necessary to give an adequate driving pitch at critical points, etc.

In order to follow and report the progress of drives, it has been found advantageous to place mile posts on the banks of the streams being driven. These are usually numbered boards nailed up in conspicuous places, the mileage being measured from the mouth of the main river, and a new count being used on each tributary, starting from its mouth.

Wood Handling Plants

Unless all the timber on a particular river is controlled under one ownership, the question of adequate holding and sorting space is of great importance. The layout should be planned so that facilities at first installed can still be utilized in the future when more space and additional facilities are required due to increased quantities of wood being driven and used.

In sorting, the current is taken advantage of, and wherever possible the hauling-out plant should be so placed that the tendency is for the wood to float on to the chains.

Cutting-up plants, barking plants and loading apparatus should be so arranged that they can be run independently. There should also be space for a large reserve of wood, available at all times for rapid loading, the reserve being replenished between loading periods. At the same time, it should be possible for the wood which is cut up and barked during the period of loading to pass directly into the cars or vessels being loaded, thereby saving rehandling of that portion.

Any layout is, of course, limited by the natural features of the location to a large extent, but frequently the wood can be delivered to the cutting-up plant, barking plant, reserve piles, cars or vessels by the use of flumes and gravity, or one or the other in combination with some other form of power, with a resultant saving in the total amount of power which would otherwise be required.

Labour is the largest item entering into the cost of pulpwood and logs, and any mechanical device which eliminates a handling or lessens the amount of manual labour usually saves both time and money.

Visualization of Operating Progress

Where large quantities of wood are being cut, and operations are being conducted in several different districts or regions, it is extremely difficult for company executives to visualize the progress being made, in detail, from the tabulated progress reports. This obstacle is overcome to a large extent by the use of copies of the operating maps referred to under the heading "Annual Logging Plans."

As stated therein, the contractor's name has been placed on the map on the area assigned to him. To this is added the approximate quantity of wood covered by his contract, the dates he is expected to be up to schedule production on cutting and hauling, and the schedule amount he is supposed to cut and haul per week.

When the weekly logging inspection and progress report for each contractor is received, pins with coloured heads of different sizes, each size representing a certain quantity of wood, are inserted in his area, corresponding to the amount of wood cut as shown by the report, and where there is a deficit according to schedule "danger signal" pins of another colour are also inserted for the amount of the deficit.

From week to week additional pins are added as further reports are received, and, if desired, each week's cut can be separated from that of the preceding one by smaller pins of another colour.

Similarly in regard to the hauling, pins of other colours are inserted in the map near the approximate locations of the landings, representing the quantity of wood hauled; one colour being used for that landed on the ice as the place of final delivery and another colour for that delivered on the bank. "Danger signal" pins are also used where hauling is behind schedule.

This method of procedure shows at a glance how cutting and hauling is progressing, and permits comparisons between districts, and contractors, and indicates which ones are behind on their schedules and need pushing.

The visual presentation constantly emphasizes such points in detail, where in the tabulated reports they may be obscured or lost sight of, at least temporarily if not entirely, or until it may be too late to prescribe a remedy.

The amount of wood remaining to be hauled at any report date is readily seen by comparing the "cut" pins with the "landed" pins. When the final hauling report has been received, all the "cut" pins are removed except those representing the amounts cut but not hauled.

At the time of the drive, pins representing "wood landed on the ice" then correspond to the quantity already delivered in the water, and, as the balance of the wood is rolled, pins are changed to the corresponding colour. As reports are received showing the progress of the drive to various known points, pins are advanced down the streams accordingly.

Pins of distinctive colours are used to indicate the head and tail of the drive on each stream. Wood left back, and its approximate quantity and location, is so indicated by pins remaining back of the "tail" pins.

With mile posts marked on the maps to correspond with those placed along the streams, as mentioned under the heading "Driving," the progress being made can be readily followed and conclusions reached as to what drives should be pushed harder or perhaps abandoned for the time being, how the output of the various tributaries is coming into the main river, and plans for moving crews from one place to another can be made in advance more intelligently when the whole operation is in clear view.

Records of Forest Operations

In making the maps accompanying the forest inventory, as well as other maps of record, a legend is used which permits showing subsequent changes, such as cuttings, burns, windfalls, etc., by additions thereto in the form of cross-hatching in distinctive colours.

In order that the maps may be of the greatest value in future operations, as well as constituting an up-to-date record of what has happened in the past, surveys of cuttings, burns, etc., are made promptly after they occur, and their extent is shown on the maps. Tabular statements are kept for each district, watershed and logging unit. The original entries show the merchantable areas in acres and the quantities of timber found therein at the time of the forest inventory.

Where cuttings have been made previous to the forest inventory and the amounts removed are known, these figures are entered ahead of the inventory data to arrive as nearly as possible at the quantity of the original stand. At the end of each logging season, the merchantable area cut over and the amount of timber removed is deducted and the balance remaining shown.

Similar deductions are made to cover losses resulting from fire, insect depredations, etc., and from time to time adjustments have to be made to take care of over-runs, shortages and differences found as cuttings proceed and when subsequent timber estimates are made. This part of the record is referred to as the *timber cut and standing* statement, and is particularly valuable in showing original quantities of timber, amounts removed by seasons, the balance remaining and its distribution.

Statements are also compiled showing the amount of timber removed per acre of merchantable area, from each area contracted, logging unit and watershed, for each season's operation. Graphs are made for individual logging units and watersheds, showing contract price variations and differences in length of haul, and are carried along from season to season to indicate trend and for comparative purposes.

Comparative statements for successive operating seasons are compiled showing in detail the individual items contributing to the total cost per cord or per thousand feet delivered in the mill pond or at shipping point, the principal items and their subdivisions being as follows:—

Woods expenses:
- Superintendence,
- Surveying and exploring,
- Logging plans,
- Inspection, scaling and stamping,
- Forest protection,
- Woods office expenses,
- Maintenance and repairs of buildings, roads and telephone lines,
- Equipment consumption,
- Depreciation on woods improvements,
- Insurance,
- Miscellaneous woods expenses.

Contract cost of landed wood:

Stumpage and depletion:

Total landed cost

Driving expenses:
- Superintendence,
- Rolling wood,
- Driving, rafting, booming and sluicing,
  - (a) On tributary streams,
  - (b) On main river,
- Sorting,
- Shore rentals and land damages,
- Maintenance and repairs of driving improvements,
- Equipment consumption,
- Depreciation on driving improvements,
- Insurance,
- Miscellaneous driving expenses,
- Drive shrinkage.

Total driven cost

General expenses:
- Head Office:
  - Salaries,
  - Supplies and expenses,
  - Telephones and telegrams,
  - Travelling expense,
- Maintenance and repairs of buildings, furniture and fixtures,
- Depreciation,
- Insurance,
- Taxes,
- Legal expense,
- Charities and donations,
- Audit fees,
- Miscellaneous general charges.

Total delivered cost

While accounting procedures vary materially, the end in view should always be to present *cost facts* promptly, at frequent intervals, in a clear-cut manner, permitting easy analysis of the costs of each part or step in the operation whenever desired, and these statements form the basis from which future budgets and cost estimates are derived.

Forest Protection

The protection of the forest from fire is of prime importance, for without adequate preventive measures and proper facilities for extinguishing fires when they occur, all other plans for the perpetuation of the forest through efficient management and operation are of little use.

Each provincial government has its protection service which affords protection principally to unoccupied Crown lands and settled districts and co-operates with the Board of Railway Commissioners, the Forest Protective Associations, and individual owners.

In the province of Quebec, in 1925, the government fire protection staff included 1,745 inspectors, fire-rangers and auxiliary rangers, whose sphere of activity covered approximately 100,000 square miles of unoccupied Crown lands and settled districts, while the five co-operative associations had under their supervision and control some 71,000 square miles of licensed Crown lands and private holdings, on which they employed a staff of 1,434 men.

Private owners employed 235 more, making a grand total of over 3,400 engaged in the various fire protective services during the fire season, as compared with a total of about 400 ten years ago.

The general fire protection system has been improved in recent years by the extension of telephone lines through the forest and in linking up the look-out stations, by increasing the number of observation towers and railway speeder patrols, by the use of air craft, portable fire pumps and other modern fire-fighting equipment, by special legislation requiring the use of burning and travel permits, and by educational campaigns conducted throughout the country.

However, great difficulty is encountered in attempting to build up efficient field organizations for apprehending and combating fires. The work is seasonal and men of the type best fitted for these duties hesitate to take them up, as they desire year-round employment. To engage themselves for the period of the fire season often prevents them from completing spring work, such as the drives or may prevent them from obtaining the fall and winter jobs they desire, as they are not available when the work commences. In consequence, a large part of the ranging force is often composed of young men seeking summer jobs, who lack experience, and, while they may develop during the season, most of them do not return the following year, with the result that another green crew has to be taken on.

Until forest protection is recognized to be of sufficient importance to guarantee the men engaged in it year-round employment, just so long will it be impossible to obtain sufficient men of the right type and experience, and the results obtained will continue to be far below the standard desired.

Recognition of this fact is gradually becoming more widespread, and some of the organizations engaged in woodlands operation are now providing steady employment for the fire protection staff. Men who are scalers, stampers, logging inspectors, woods clerks and storekeepers during the fall and winter months are transferred to forest protective work as required, and are again placed in their former positions when the fire season is over. It is sometimes inconvenient to transfer a man just when he is needed, but if the principle is admitted that protection comes first there is no room for argument.

Where a number of men are engaged in protecting the same lands that they assist in operating, and vice versa, thereby receiving year-round employment, their work develops into more than a job for them; they see opportunities to display their ability and for advancement, and, with a reasonable amount of encouragement, become personally interested in the whole undertaking.

Personnel in Forest Operations

The methods outlined in the foregoing are the result of endeavours to co-ordinate the knowledge of the experienced operator with that of the engineer. Fundamental methods and practices have not been changed but rather have been amplified and systematized.

The training of the engineer has been brought into play to obtain and record information pertaining to the forest and its operation, the use of which increases the efficiency of the logging organization, and to collect and keep up-to-date such information as the executive heads of the controlling organization may require from time to time, relative to immediate and future wood supply, operating plans for the future, improvement and operating budgets, wood-handling plants, transportation facilities, depreciation charges, depletion and replacements, etc. Accordingly, a well-balanced personnel necessarily includes one or more persons of technical and engineering training, their number depending on the magnitude of the undertaking.

The value of the operator who has had to rely on the hard school of practical experience for all his knowledge should not be underestimated. However, men of higher education and technical training who are willing to apply themselves conscientiously to securing first-hand knowledge of logging methods in actual operations can and do become able woodlands managers and executives within a comparatively short space of time and without the excessive tedium often undergone by those of limited education.

Trend of Forest Utilization in Canada

In the Lumber Industry

While the lumber industry of Canada is of great magnitude, still the average amount produced annually during the last eighteen years has fluctuated up and down rather than showing any steady increase in production, as has occurred in the pulp and paper industry.

The lumber industry reached its peak in 1911 with a production of 4.92 billion F.B.M. In 1908, 3.35 billion F.B.M. were produced and in 1922, 3.14 billion F.B.M., the intervening years coming within the range quoted.

In the Pulp and Paper Industry

Compare with the above figures the consumption of forest products in the Canadian pulp and paper mills:—

In 1908	483,000 cords
In 1915	1,406,000 cords
In 1920	2,777,000 cords
In 1925	3,669,000 cords

This shows an *increase* in consumption of over 650 per cent in the seventeen years mentioned. During the same period the quantity of pulpwood converted into pulp and paper in mills situated in the province of Quebec has increased from 256,000 cords in 1908 to 1,765,000 cords in 1925.

The pulp and paper industry now controls the greater part of the timber lands situated in the eastern provinces. In consequence, pulpwood production and the perpetuation of the forest as a source of adequate supply for future requirements are the main problems in woodlands management in the east to-day.

Note:—Various statistical figures quoted are from the Canada Year Book, and publications of the Forestry Branch, Department of the Interior, Canada.

Transportation in Pulpwood Operations

Some Features Entering into the Transportation of Men and Supplies to Operating Areas and Pulpwood from the Stumps to the Mill

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The pulpwood transportation problems which arise in eastern Canada may be classed under two headings:—(1) Transportation of men, provisions, equipment, etc., to the operating areas; (2) Transportation of the pulpwood from the stump to the mill.

Transportation of Men, Provisions and Equipment

Allowing 4 pounds of food per man and 50 pounds per horse, some 40 pounds of freight are sometimes required for each cord of wood cut, and, with such restless labour as is employed in logging operations to-day, it may be assumed that the labour turnover on 100 cords from stump to mill is approximately 3 men. To take a concrete example, let us assume an operation of which the centre is located at 50 miles from the railway and cutting 225,000 cords to supply a 500-ton-a-day paper mill. The total transport for such an operation would be 9,000,000 pounds of freight and 7,000 men. The cutting season would start in August and finish in March. The drive and river improvement season, starting in late April, would last until November.

Very few companies are so located as to be able to transport all of this by water, and many companies, therefore, are adopting a "good road" policy, using mechanical transport. The capital expenditure of such a policy is large but the maintenance is less, and there are many other advantages, such as:—

(*a*) The lumberjack can be transported to the cutting area in one day, whereas three days are taken by horse transport. In some cases they are paid and given their board while going to the cutting area, and on a labour turnover as shown above the saving with mechanical transport is substantial.

(*b*) It can be conservatively stated that mechanical transport in the woods costs less than half of horse transport.

(*c*) Loss of interest, depreciation and insurance on stocks carried during the previous winter on snow roads is lessened.

(*d*) Forest fires can be much more easily fought when good roads exist, as men can be transported quickly to the scene of the fire. One forest fire quickly stopped will result in a saving sufficient to pay for many miles of road.

The general specifications for these roads include the provision of a wide clearing to help the ditches to receive full benefit of the sun and wind and to give sufficient room to deposit the ploughed snow during winter. The distance between ditches should not be more than 15 feet, and the road proper, generally gravel, not more than 8 feet wide.

The grades should not be more than 10 per cent, so as to use tractors to their full advantage, while the alignment should be as good as possible so as to permit use of one or more trailers. Bridges and culverts should be built of peeled logs, and all other requirements should be in accordance with ordinary highway practice.

In ordinary country, $5,000 a mile will go a long way towards making a good road. With medium tractors, loads of 20,000 to 30,000 pounds in summer and 60,000 to 70,000 pounds in winter can be hauled.

Accommodation and Communication Service

To lodge men and beasts passing along these roads, and also at distributing centres, provision of stopping places must be made.

The usual practice followed in construction camps is employed, i.e., 30 to 40 square feet per man, with ample provision for heating, as most of the transients have been in cold open vehicles all day.

Stabling is a problem in itself, each horse requiring 800 cubic feet of space, one window and 15 square inches of ventilation. The stables also have to be made warm, as they are empty all day.

All buildings are made of sawn lumber, this being an economy over the old style log cabin. To supply this, gas-driven or water-driven portable saw mills are used, equipped with carriage, edger and planer.

Telephones are essential to logging operations, and, except where transmission lines exist, are ground return, with No. 9 wire looped through porcelain knobs attached to the trees. These wires are not very liable to damage if a tree falls on them. The reason why few metallic circuits are used is not only to avoid the comparatively small cost of the pole line, itself carrying the two wires on solid insulators, but also to avoid the more expensive clearing of a right-of-way wide enough to prevent line breakage by falling trees.

Transportation of Pulpwood from the Stump to the Mill

Timber in pulpwood forests in eastern Canada is, as a rule, small and scattered. It is therefore improbable that

Figure No. 1.—A Typical Bridge as Used on Bush Roads.

Figure No. 2.—A Log Jam.

overhead or ground mechanical skidding from the stump to the yarding areas, as practised in the west, will be practicable here for a long time to come. Horses will continue to be used for hauls up to 3 miles.

It is not intended to enter into the details of hauling with horses from the stump to the yards or landings, but rather to deal now with the transportation of the wood from the landings to the mill.

This transportation may be by water, by land, or by a combination of the two.

Transportation of pulpwood by water can be carried out in the following ways, separately or combined:—(1) driving streams and lakes; (2) towing rafts; (3) fluming; (4) barging.

Driving Streams and Lakes

Driving streams and lakes is simply a matter of placing logs in the river and allowing them to float down with the current. Theoretically, driving operations will be cheaper if carried out in low water. The reason is obvious. High water will strand the logs high and dry, and to bring them back into the channel is one of the big expenses of the drive and is called the "sweep." Another axiom is that the longer the log, the more expensive the drive. For this reason, creeks of but two or three square miles' drainage area are driven in four-foot lengths very economically.

River Improvements

In order to attain the ideal of driving, that is, at low water, the stream must be improved. The object of these improvements is to keep the logs floating down in the deepest part of the river channel, and to achieve this the following are necessary:—

Remove from the sides all brush, etc., which would hold up the floating logs.

Remove from the channel all rocks which might stop the logs, care being taken not to remove rocks near the shore which protect the bank from scouring.

Build wing dams, so as to confine all possible water to the main channel and to keep logs out of high water channels and off shoals.

A wing dam is generally built in the form of a rock-filled crib, with a width equal to its height, the minimum being 6 feet. The life of these dams is about ten years, but to increase this on regular driving rivers where foundations of solid rock may be secured, concrete quays have been built. Some experimenting has been done towards using precast reinforced concrete cribs. (See figure No. 3.)

Dams

To facilitate driving, flushes of water are required as a general rule; and to impound water two kinds of dams, storage and flush, are used. In estimating the required storage, a depth of one foot of water over the drainage area gives good results.

Flush dams are generally so located as to permit the relay of water to pass over difficult stretches of river. Frequently long wide dead waters have rapids below them, and to float logs down these a certain depth of water is required. Flush water coming from above takes a long time to fill these dead waters to a point where they will discharge enough to float logs through the stretches referred to; and as logs travel more quickly than water a delay and a loss of water will occur. Flush dams are therefore built to remedy this by relaying the necessary water.

These dams are generally built of wood either as rock- or earth-filled crib dams, or hollow dams with inclined upstream face. The foundations of these dams very often present difficulties, as rock bottom is generally too expensive to reach. The sheeting of the face of the dam is used as a cut-off wall, and is placed in the ground to the required depth, depending on the soil.

As these dams are seldom more than 15 feet high, the cut-off wall is never sunk more than the height of the dam. However, as a further precaution against percolation, the excavation in front of the dam is carried to a width of sometimes two or three times the height of the dam opposite the particular section. The excavated part is then filled with moss and woven balsam branches, over which is placed sand, gravel and clay, which, when well compacted, becomes hard and the coefficient of percolation is therefore increased. The dam, if properly built, will give very good service under these conditions, even with very poor foundations.

Lakes

Generally speaking, lakes are a hindrance to the drive, except for the storage of water. The ice on them thaws later than on the streams and delays progress. When the drive can be operated with the wind they are improved by booming off deep bays and parts covered at high water only.

Figure No. 3.—A Wing Dam with Skeleton Made of Precast Reinforced Concrete Timbers.

Figure No. 4.—Typical Section—Hollow or Beaver Type Driving Dam.

When the prevailing winds do not agree with the direction of the drive it is necessary to resort to towing.

Towing of Rafts

Logs, floating loosely in a floating enclosure, consisting of long pieces of timber joined together with chains and called booms, are towed to their destination by tugs of various kinds. There is no other operation in pulpwood handling in which good or poor equipment will influence the cost as much as in rafting.

Shallow Towing

As it is impossible to use high-powered tugs economically when rafting in shallow bodies of water, warping craft are used.

A drum, around which a mile or so of cable is wound, is geared to the engine of the boat. An anchor is attached to the end of the cable. The tug goes ahead of the raft, drops the anchor, and, paying out the cable, returns to connect up with the raft. By winding up the cable on the drum, both tug and raft are pulled forward to the anchor. This type of craft is economical for shallow bodies of water and for short tows, and is very handy for making up rafts, closing, opening and manoeuvring.

The engines used vary from the Ford marine engine equipped with a small drum or nigger-head and placed in an 18-foot punt to the high-powered 30- to 100-h.p. steam or Diesel engine placed on boats with steel hulls 70 to 80 feet long. On account of the cheapness, this type of craft is sometimes used on deep water long tows, but the cost of operation and the risk are then high, since the time to cover the tow is much greater than in the case of a straight pull, and in high winds the tug is in difficulties, being held down at one end by the raft and at the other end by the cable, so that unless the boat has a lot of free board and is very seaworthy it will have to abandon its tow to seek protection.

The following will give an idea of the performance of this type of boat:—

(1) Tow of 60 miles takes ten days, a 60-h.p. steam warping tug being used; a crew of ten men for day and night; wood used for fuel at the rate of 5 cords per 24 hours. Average tow is 2,500 cords. Lake shallow but offers good protection against wind. Draft 36 inches, punt style 70 by 18 feet.

(2) Tow of 12½ miles taking 24 hours, a 100-h.p. Diesel warping tug being used; a crew of 7 men for day and night; crude oil used at the rate of 4 gallons per hour warping and 6 gallons per hour on the screw. Average tow 1,500 cords. Lake deep and offering no protection from the wind. Draft 4 to 5 feet; length 60 feet.

It may be said that in the second case the boat's raft is limited by the wind, but otherwise it could tow 3,000 cords under same conditions as the first example.

Deep Water Towing

It may be stated, roughly, that wherever a tug can swing a 6-foot propeller the ordinary high-power tug will tow more economically than the warping tug. It is faster, and in high winds it can tow more easily and with less risk.

The following performances will give an idea of the different capacities of this type of tug:—

(1) Tow of 28 miles takes 26 hours; 450-h.p. steam tug being used; crew of 8 men for day and night; bunker oil fuel used at rate of 60 to 70 gallons per hour. Average tow 4,500 cords. No protection from wind, boat and rafts weathering practically any weather. Draft 10 feet, length 105 feet.

(2) Tow of 40 miles takes 60 hours; steam tug about 300-h.p.; coal fuel used at rate of 15 tons for the trip. Average tow 2,000 cords. Good wind protection. Length 90 feet, draft 11 feet.

(3) Tow of 20 miles takes day and night for return trip; 350-h.p. Diesel tug used; crew of 8 men for day and night; fuel oil used at rate of 300 gallons per trip of 24 hours. Average tow 2,000 cords, restricted by narrowness of river; could probably tow 3,000 to 3,500 cords without difficulty under better conditions. Very good wind protection. Draft about 9 feet, length 90 feet.

These figures must be taken with certain restrictions. The efficiencies of the engines were not measured; the above figures being those at which the engines were bought. The range of the different performances is also wide. The figures, however, are sufficiently accurate to show the economy of the Diesel type over the steam engine for this class of work. The former type has also the following advantages over the latter:—

Lighter fuel and engine for the same power, therefore reduction of draft and more space for crew in same sized boats.

The initial cost is about the same in each type.

The main disadvantages of the Diesel type are:—

Difficulty of using power for auxiliary purposes, such as for anchor winches, pumps for water ballast, etc.

Heat for late fall and early spring not available.

A little more difficulty in manoeuvring, as the ranges of speed are not so pronounced as in steam.

One other point brought out by these figures is the small capital cost of the warping tug as compared with the ordinary tug; and the high operating cost of the warping tug compared to the ordinary tug.

Booms

In a towing operation, booms are a very important part of the equipment. They must be large enough to prevent the logs from passing either under or over them while on the tow or in high winds.

The accompanying sketch, (figure No. 5), shows a type of spool boom which gives very good satisfaction at a low cost. The one-strand chain is lighter than the usual belt and the swivel keeps the chain from corking and breaking. It often happens that booms of logs are stranded in a tow, and the swivel will permit the boom to roll over on itself and not break when the boom is in movement. The

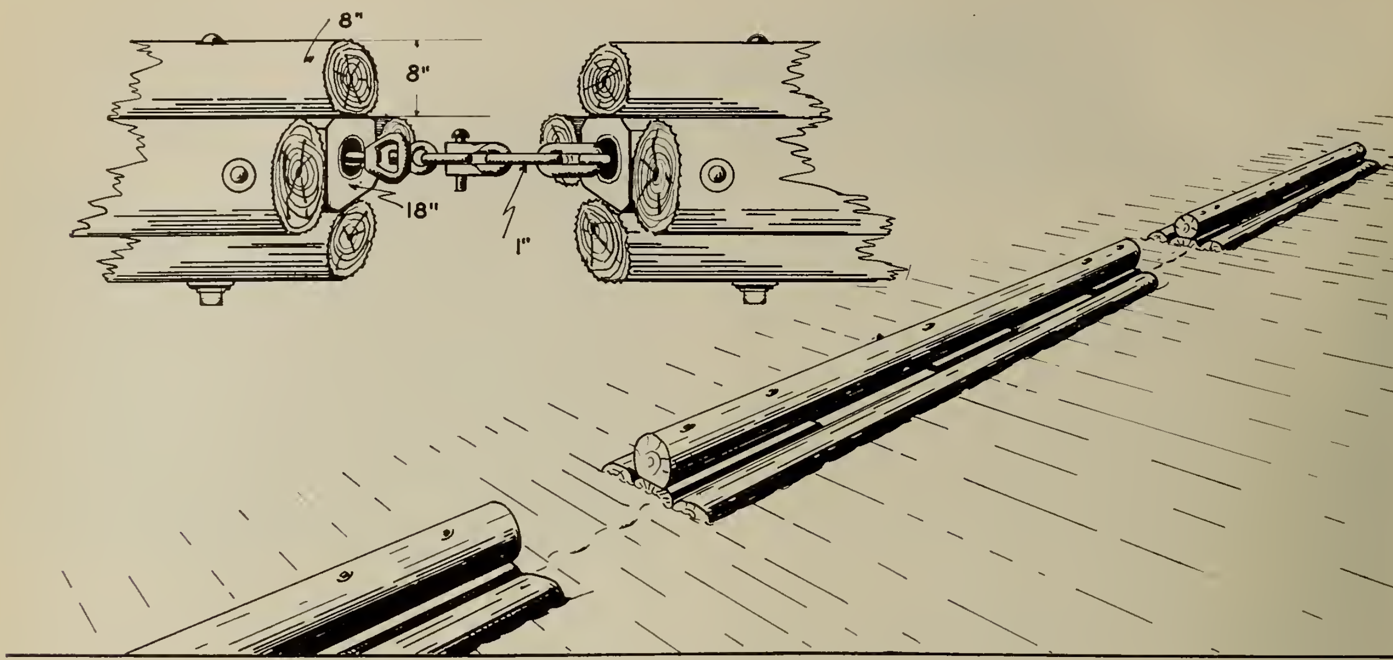


Figure No. 5.—Towing Spool Boom.

wear of the chain on the boom is very slight as compared with the other types, due to the nipple inserted in the end.

It is often required to stop large amounts of pulpwood on large rivers. On account of the big loss involved should failure occur, the holding must be secure.

In choosing a place for holding logs, two kinds of site are generally sought, or a combination of the two. The first, which is generally the cheapest, is a wide deep section of river where the water velocity is low, a boom is then stretched with guys attached to anchors or submerged piers, the booms and guys taking all the strain. Sometimes it is difficult to find such a site, and a shallow site is then chosen. Big piers are built and a boom stretched below the piers. Guys called " top " are placed above the water; and " bottom " guys are placed in the water as in the preceding case.

The logs come down and jam between the boom and the piers, forming a solid mass above the piers. The strain is taken mostly by the piers, and, as the logs sometimes jam to the bottom of the river, the piers are sometimes relieved of some of the strain. The boom is held in place by the top and bottom guys and should not have too great a strain if well stretched and if the piers are properly distributed. In both these cases the site is preferable at a bend in the river. The line of greatest resistance of the boom and piers starts from the apex of the convex side and finishes near the downstream point of tangent on the concave side. In this fashion the concave side takes a part of the strain, and the swifter water on this side has but a short length of boom against which to act. The bulk of the logs strain the boom where there is less current, i.e., near the convex side.

Flumes

Flumes have many practical applications in the pulpwood industry, the principal of which are:—

Transferring logs from one watershed to another, thereby avoiding some expensive operation, such as rafting, railing, etc.

Passing rapids, falls, dams, etc., which is an expensive operation.

Loading barges, etc., for deep sea transportation.

Operation

Their operation is simple and the cost depends greatly on uniformity of grade, reasonable curvature, easy entrance to flume and a good emptying point. More men will be necessary to operate a flume if the various grades and curves accelerate or diminish the velocity of water, and so cause the logs to bunch and jam.

Water and logs are as a general rule admitted into the flume by gravity, although in some cases pumps and jack-ladders are used. The ponds should be large enough to hold a good reserve of logs, as delay is more apt to occur in fluming if the pond has to be continuously refilled from the river above. The intake should be placed in that part of the river where the current has most velocity. This will diminish the crew sluicing and feeding the flume. For the same reason the flume intake should be placed near enough to the ordinary sluice gates to profit by their drawing effect.

If the intake is in an hydro-electric development dam, it should be placed near the penstock intakes, in order to get full possible benefit of the current drawing in this direction. To increase the current velocity, various expedients are resorted to, such as filling the forebay entrance level with the sills or placing semi-floating troughs, with the general idea of diminishing the area of the section and so increasing the velocity to draw logs to the flume intake. Stationary winches, operated by gas engines or some other type of engine, are also used to draw the logs to the flume intake.

The location of the emptying point is also important. The flume should fall into deep running water, otherwise the logs will pile up and block the flume.

Operating Personnel and Flume Capacity

The personnel depends mainly on the quantity of logs to be flumed in a certain time and on the grades and alignment, while the capacity also depends on these factors plus personnel and size of box. The following concrete examples, taken from actual practice, with logs averaging 12 feet in length and 6 inches at small end, will illustrate these points more clearly.

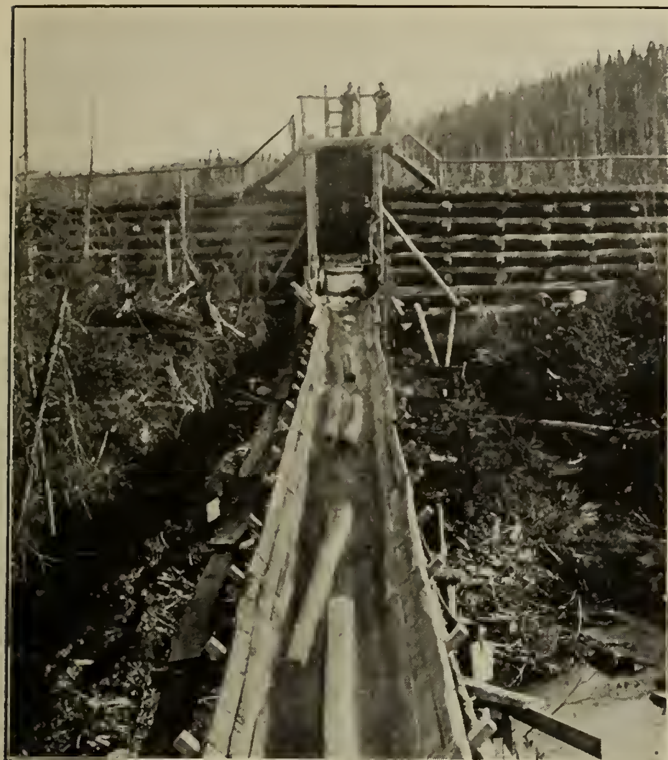


Figure No. 6.—Typical Flume Intake.

No. 1 flume, 11 miles long, practically uniform grade 0.2 per cent; a 48-inch V-box, using about 35 second-feet, with a crew of 50 men, will pass throughout a season an average of 2,000 logs per hour, curves being no hindrance.

The same flume operated with 25 men will pass, on an average, through a season 1,200 logs per hour with less mishaps than with the 50 men passing more logs.

No. 2 flume, 3 miles long, first 1.5 mile with a grade of 0.2 per cent, the remainder varying from 1 to 5 per cent; using about 25 second-feet, passes on an average 1,000 logs per hour with a crew of 12 men. One curve of 28° in the 0.2 per cent grade requires a guardian continually.

No. 3 flume, 2 miles long, with a practically uniform grade of 0.24 per cent; a 40-inch V-box, using about 25 second-feet, with a crew of 20 men, passes on an average 1,600 logs an hour, with bad curves all guarded.

No. 4 flume, 2 miles long, the grade varying from 0.4 to 4 per cent, with frequent changes; a 30-inch V-box, using about 20 second-feet; crew of 11 men, passes, on an average, 1,000 logs per hour; curves no hindrance.

No. 5 flume, 1½ miles long, with a grade average about 11 per cent and maximum 20 per cent; a 28-inch V-box, using about 15 second-feet; a crew of 5 men could pass an average of 2,000 to 3,000 logs per hour without difficulty, but on account of restricted banks at the pond this cannot be attained as an average, but only on trials. The average of this flume is 1,500 logs per hour.

A review of these figures will show that there are no hard and fast rules for the cost of operation of flumes, but that each case must be studied individually, having regard to grade, alignments, water, time allowed and quantity of logs to be flumed. If you have a large number of logs to flume in a short time, your unit cost will probably be higher than if you had the same quantity to flume over a longer period. The length and size of log, of course, influence your price per cord.

Design

The V-section with a 90° angle seems to be the most practical for our bush operations. It is easy to construct; it is generally built by common labour, with very few carpenters; it requires less water to float a log; and it is not apt to jam so much as other types of section.

Grades from 0.2 to 20 per cent have been built and successfully operated by the writer, and there is no doubt that the flatter or steeper grades can be employed provided the hydraulic functions of Kutter's formula $V = c\sqrt{rs}$ are adhered to.

A greater velocity will be obtained in the flat grades by an increase of the quantity of water, or a diminution of the coefficient of friction, but the foundations will have to be good, as the least settling will cause the flume to overflow. The problem in the case of steep grades is to get enough water in the box to prevent the logs wearing it out; and the solution of this problem depends to a large extent upon the amount of money you can afford to spend.

The curve is influenced mainly by the length of log. Sharp curves should not be placed on steep grades or at the foot of such grades. With 12-foot logs 30° curves can be negotiated on slight grades, but in operation these curves will require a guardian.

The quantity of water and the size of box are governed by grades, drainage area available, size of log and the capacity required.

No. 5 flume, described above, has only one square mile of drainage area above it, and is employed during fifteen days each May to pass 150,000 to 200,000 logs without any shortage of water.

Type of Construction

Steel or concrete constructions should not be used for permanent flumes unless very good foundations are available. Jams and consequent overflow of water or breakages are possible on the best of flumes, and the necessary repairs to steel or concrete constructions in such events would cause serious delays. Wood is more suitable in these circum-

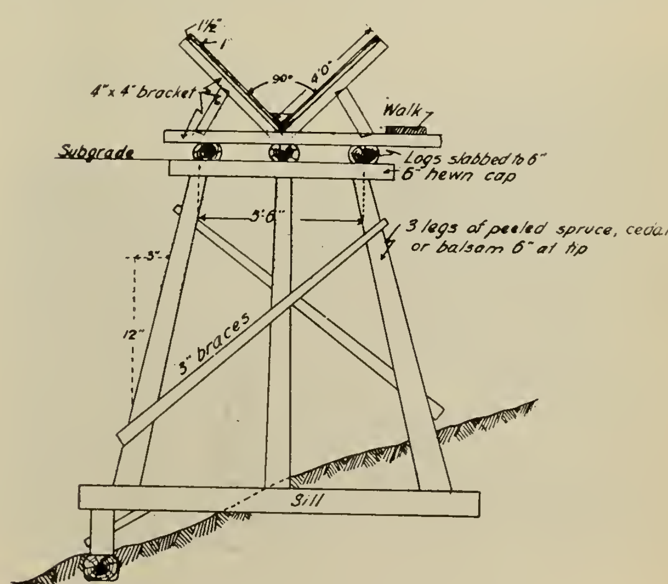


Figure No. 7.—Typical Flume Section.

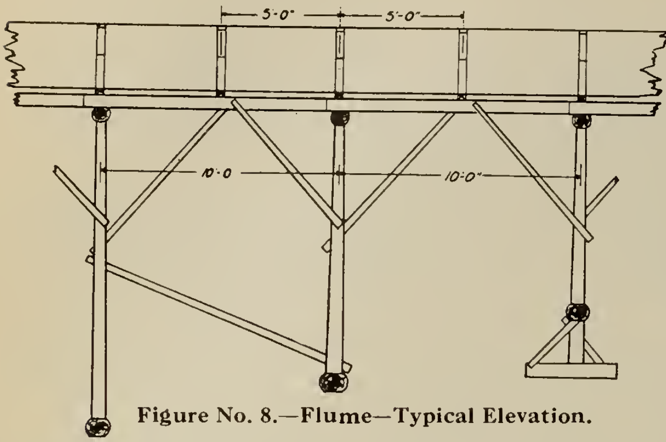


Figure No. 8.—Flume—Typical Elevation.

stances, and substructures of cedar are cheap and last a long time.

The box is of two thicknesses of spruce. The bottom layer should be thick enough to receive the nailing, while the top layer may be inferior 1-inch boards. Top sheeting should be placed at break joint to give more rigidity.

Usual practice is followed with regard to stringers, allowing a good safety factor on account of fatigue.

If for a permanent flume the saddles or brackets should not be less than 4 by 4 feet notched, as they are subjected to great strain when a jam occurs, tending to wedge the box open.

All other details are in accordance with the usual practice in timber construction. Creosoting all joints lengthens the life of the flume, and there is no objection to the use of green timber as water and dirt tightens the joints.

Location and Construction

The operation of the flume is influenced by its location, and many features governing the location of railways apply in the case of flumes. Side hills with soil that is easily washed should be avoided, as an overflow will wash away the foundations.

For a short flume, it is sometimes economical to instal a portable sawmill at the head of the flume and to float the sawn lumber down the flume as the building progresses. For a long flume, it seems more economical to spread out the work and to operate your sawmill at two or three centres, as it is only very rarely that a good road runs parallel to the whole length of the flume. Wire nails can be used freely, in preference to iron. Given handy wood and a gas-driven portable sawmill, the inclusive cost of building, including the lumber from the stump and nails, would be about $40 per 1,000 feet. Only a few carpenters need be employed, the balance being good bush labour.

Flume System

Feeding their Kenogami mill, Messrs. Price Bros. have the following flume system, which is illustrated in figure No. 11.

Logs cut on Valin and Shipshaw, to be used in Kenogami paper mills, would normally have to be driven down the Valin and the Shipshaw, towed to Chicoutimi wharf, loaded on cars and railed to Kenogami. With the flume system shown in figure No. 11, Valin river logs, which are all above the flume intake, are flumed to the Shipshaw and floated down with the Shipshaw logs to another flume intake on the same river, and from there flumed to one of the Kenogami mill slashers.

The system with due consideration for depreciation, etc., operates at about one-half the cost of the usual method, *i.e.* towing and railing, as above mentioned.

Barges

On large bodies of water, such as the St. Lawrence river, where the pulpwood has to be transported over long distances, it is sometimes impracticable to tow in open rafts. The wood is then loaded on to barges or freighters, which have a capacity varying from 40 to 1,500 cords. The pulpwood is cut into 4-foot and 2-foot lengths, and is loaded into the boats by means of a flume or a jackladder. The boats are either towed or travel under their own power to their destinations.

At the destination the wood is unloaded by various means; by hand labour, grapples, conveyors, etc. Some boats have been so designed as to enable them to be partly sunk, the pulpwood cargo then floating off by itself.

Although less risky than towing in open rafts, this method of transportation is more expensive on account of requiring loading equipment and operation, towing and towing equipment, and unloading equipment and operation.

In Sweden certain devices are used which might have application in this country. The pulpwood is loaded into

Figure No. 9.—Typical Scene on a Flume, Showing Guardian and Logs Going Down.

Figure No. 10.—A High Trestle Flume—Subgrade 80 feet above Sills.

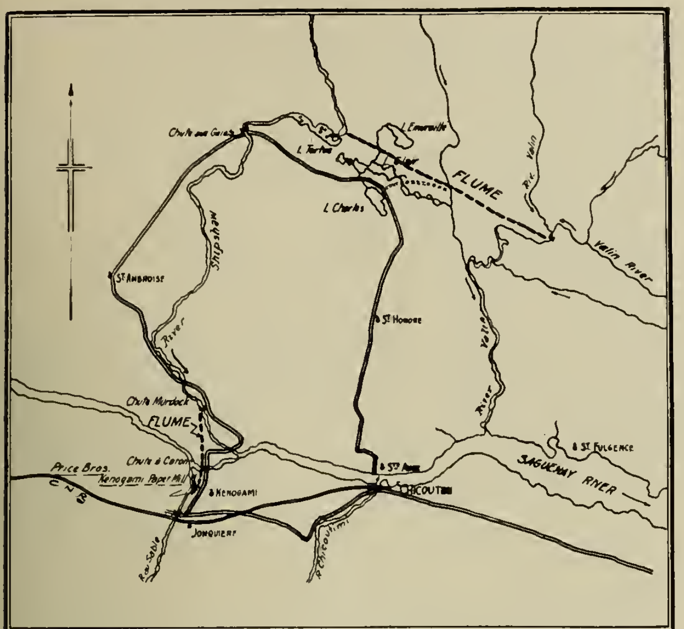


Figure No. 11.—Plan Showing Flume System to Avoid Towing and Railroad Operations.

floating racks, at a much lower cost per cord, both as to capital cost and maintenance, than any type of boat. These racks, of course, tow harder, but on the other hand they can be very easily unloaded when at the mill boom. One side of the rack is so arranged that it can be lowered easily, the rack then pulled forward so that the pulpwood comes out by itself. The author understands that in British Columbia shingle bolts are transported in this same manner.

Land Transportation of Pulpwood

Horse transportation from the stump will not be discussed in this paper, although it can sometimes compete satisfactorily with mechanical transport for hauls up to three or, as is sometimes claimed, five miles. The other methods of land transportation will be outlined under three headings:—by tractor, by railway, by bush railway.

Transportation by Tractor

Under this heading it is intended to consider transportation over snow roads only. These roads should be cut with a right-of-way 30 to 50 feet to allow ample space for the snow when it is removed by the snow plow. The roads should be well stumped and grubbed, and up grades should be avoided as much as possible. The ideal condition is to have a down hill road, even at the expense of distance. They should be kept as free from snow as possible, and generally iced, in order to increase the traction and to give a solid foundation.

The pulpwood, which is piled at the sides of the road, is loaded on to sleighs by jammers, operated by horses or power. The sleighs are made of wood with steel shod runners and are of the ordinary bob sleigh type, as used by horses, except that the timbers are much heavier and 12-foot bunks are usually used. Trains are sometimes made with smaller tractors and hauled to the landing. Extra sets of sleighs are often used to avoid delaying the tractor. At the landing, which must be prepared to receive the logs, the sleighs are unloaded by jammers, operated by a gas or steam engine.

The following performance will give some idea of the work that can be done with a tractor.

A 60-h.p. tractor of the semi-heavy type, weighing 10,000 pounds, with caterpillars on tractor part only and the front on runners; operating for 71 days, which can be considered a maximum for snow roads, even in northern Quebec.

Average length of haul, 5.5 miles.
Average number of trips per day, 3.1.
Miles per day loaded, 17.2.
Average sleighs per load, 3.87.
Average feet per sleigh Quebec scale 2,400 spruce and balsam.
Average feet per load Quebec scale 9,310 spruce and balsam.
Approximate weight of average load 90,000 to 100,000 pounds, in addition to weight of the sleighs.

The tractor was operated with one driver, one trainman and one garage man, and on an average used each day 40 gallons of gasoline and one gallon of motor oil.

Transportation by Railway

Pulpwood is very often transported by railway. Long logs are loaded on flat cars, while the short 2- and 4-foot pieces are loaded in boxed cars with open tops. The capacity of the car depends, of course, on its size. Of the ordinary run of empties furnished by the railway companies, it may be said that for 4-foot wood the capacity is about 16 cords and for 12-foot logs about 10 cords, allowing 500 feet Quebec scale to a cord.

Transporting pulpwood by rail is, of course, a question of weight. If the operation can be arranged so that the logs are not floated to the railway, the pulpwood will be lighter; but, on the other hand, it will be very expensive to bark, as economical barking requires thoroughly wet wood. If the logs have the bark removed and are dried before loading on the cars, the transportation cost will again be lowered; but the expense of equipment and operation will be very high and seldom warranted. In the block pile, moreover, pulpwood does not dry very much.

As a rule, the heaviest pulpwood is that cut in winter and placed in the water in the following spring. The lightest will be that cut in early spring and summer and not placed in water until the spring, or later, of the following year. The latter wood will have a chance to dry, and will be lighter than the former, provided it remains in the water for only a short time.

As there is no hard and fast rule for pulpwood weights, the following figures are given as a guide only:—

Figure No. 12.—A Flume During Construction.
Water-driven saw mill at dam and lumber ready to be flumed to where required.

Figure No. 13.—A Logging Tractor and Part of its Load.

	Spruce and Balsam weight per cord
Bone dry	2,150 pounds
Barked in some block piles	3,330 "
Partially barked by drive, just drawn out of water	3,900 "

The following were weighed in cars:—

Wood cut in winter; driven in May; in salt water for June and July; loaded into boats; unloaded in water and loaded on cars; and weighed almost at once. Average weight per cord was 4,690 pounds. Practically no bark was off. Wood mostly diseased balsam.

Wood cut in May, June and July; driven the following May, drive taking about two weeks; wood conveyed on shore and placed in block pile; loaded through the year from the block pile on to cars and weighed at destination. Average weight per cord was 3,481 pounds. Practically no bark was off the wood, which was mostly sound balsam.

As will be judged, the fluctuation of weights is an important factor in the planning of railway transport.

Short length pulpwood seems to be easiest to handle, but in a large operation special cars, open at the top, are required. Loading and unloading becomes a big item in large operations, if ordinary cars are used, and, in addition to this, box cars are sometimes hard to get if one has a long haul and wishes to fit in with the general traffic.

If the length of the cars is previously known, so that the logs can be cut to fit the cars, the long lengths can be better handled. However, this part of the problem is solved when the operator has his own cars. It will be seen that the problem of economical rail transport is one of reducing cord weights, coupled with the cutting of lengths to fit the cars.

Loading and unloading are separate problems which can be solved by the use of various devices, depending on the conditions under which the work has to be performed.

Railroad transportation of pulpwood may be said to be expensive, and, in most cases, more expensive than water transportation. If the wood is brought direct to the mill from the stump, it also incurs greater expense in barking, unless the wood can be placed in water before being barked. The advantages of this means of transportation are:—

Wood can be brought direct from stump to mill in any season and at very short notice. This reduces inventories and idle capital.

The loss of logs, which occurs during water transportation, is avoided.

Bush Railways

Of the many kinds of bush railways, there is one, of Swedish design, that has not yet been used in Canada, but which seems to merit consideration. It is known as the "Widegren," patented by a consulting engineer of that name in Sweden.

The road bed is built on timber trestles, high enough above ground, say, five feet, to avoid snow trouble. The rails are the stringers, placed to the gauge required and built of logs flattened on two sides for one rail, and on the four sides for the other rail.

The wheels have no flanges, but are broad and cylindrical and equipped with solid rubber tires. They are connected to the axles in the same way as the front wheels of automobiles. To keep the wheels on the rails, one of each pair is equipped with an automatic guiding device, attached to the axle and terminating in flat plates which fit against the flattened sides of the rail. It is for this reason that one rail is flattened on its four sides.

Any type of motive power can be used. The power from the engine can be transmitted through a universal joint shaft to the wheels of one or more of the trailers.

In wooded areas, where heavy transportation is necessary, this type of railway would seem to have the following applications:—

For hauling provisions, cement and material for distant hydro-electric or storage dams.

For transporting pulpwood, equipment and men.

For opening up new mining or agricultural areas, where the cost of a regular railway is not warranted.

Its advantages are:—

(1) All year operation.

(2) Low capital cost if through wooded areas, probably not exceeding $4,000 a mile where logs can be secured for 7 or 8 cents a running foot.

(3) Low operation and maintenance costs; probably less than truck or tractor hauling the same weight.

Its disadvantages for hauling pulpwood are:—

(1) As pulpwood can usually be taken out more cheaply in winter, a winter tractor road hauls as much as the Widegren and costs less, with no appreciable difference in operation.

(2) Owing to the greater difficulty of loading Widegren cars than tractor sleighs, because of the sidings, more mileage of the railway is required per square mile of timber lands than of tractor loads.

It may be said, however, that a Widegren railway would prove economical in transporting logs from one watercourse to another if a flume cannot be operated; and also in the transportation of hardwoods.

An enquiry made, at the request of the author, through The Engineering Institute of Canada to the secretary of the Svenska Teknologforeningen at Stockholm, (a technical society in Sweden), reveals the following:—

The officers of a company using the Widegren railway say that they are satisfied with the system and recommend the same as simple, inexpensive and reliable. The company has built two railroads, one of them being used for five years, both winter and summer. The cars load six to seven tons and the speed of the train can be as high as 25 to 30 kilometres per hour. The motor has 60 h.p. The track after five years is in good state and the solid rubber tires used on the wheels are only insignificantly worn. Snow is stated not to hamper the operation in any noteworthy degree. In conclusion, the company states that special conditions are necessary for the practicability of the road.

Other enquiries have given about the same information.

The Wood Consuming Industries of Canada

With Special Reference to the Pulp and Paper Industry

John Stadler, M.E.I.C.
General Manager, Lake St. John Pulp and Paper Company.

Paper to be presented at the Annual General Professional Meeting of the Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

Until about fifteen years ago, Canada's forests were considered inexhaustible, and, as a consequence of such an impression, insufficient attention was given to one of Canada's most valuable natural resources and a very large percentage was allowed to be destroyed by fire. Fortunately, times have changed and we now know more about the extent of our forests and have learned to appreciate and protect them.

According to published data on wood consumption in Canada, we find the following:—

THE PRINCIPAL USES

		*Units of Wood used	Value of product in Canada	Relative value per unit of wood used
1.	Lumber and timber in all forms except pulp wood..	1,036,037	$134,378,778	$130
2.	Firewood	866,179	39,366,771	45
3.	Pulp and paper...	388,083	232,032,227	598
4.	Railway ties......	192,459	14,251,450	74
5.	Pulpwood exported	155,639	15,536,058	100
6.	Logs exported.....	63,156	4,855,298	77
7.	**Miscellaneous ..	106,961	9,269,924	87
	Total.........	2,808,514	$449,690,506	——

Analyzing the above tabulation, it will be noted, and it seems rather a coincidence, that the pulpwood which we export gives a relative value of 100 per unit, and that the manufactured lumber gives us a value of 130; hence it would suggest itself that we should make all such pulpwood into lumber as is suitable; but statistics show that the lumber industry has declined in Canada since 1911, and in particular in eastern Canada. It seems rather peculiar that wood made into ties should yield a product of less value than pulpwood, but this is to be accounted for by the fact that woods of lower value are used in the production of ties than are suitable for pulpwood. The lowest value is obtained, as would be expected, from firewood, but the quantity used is amazing. This fact is pointed out as part of this supply might possibly be used for pulp-making purposes by replacing it with other fuels obtainable in Canada. This suggestion is made in order to relieve somewhat the minds of those who have studied the chart prepared by the Royal Commission on Pulpwood, showing that Canada's possible consumption of pulpwood, which chart is reproduced, for reference, as figure No. 1.

Whether or not this chart is correct, we might as well face the situation now; a serious problem will present itself in the near future to supply our requirements of wood for fibre-making purposes.

Although this paper is intended to cover Canada only, the writer is taking the liberty of recommending, for those who may have hopes that large quantities of pulpwood are available in northern countries located closely to Canada, a very careful study of any reports that may exist, for it is well known that the growth and reproduction diminishes as we go north, and in some northern locations soil conditions are such that timber production is out of the question.

It is not the object of this paper to go into resources of wood in Canada, but to bring before you the question of the most profitable and economical use of Canada's wood supply.

From the preceding table, it is shown that converting

* One unit is the equivalent of 1,000 cubic feet of standing timber.

** The item "Miscellaneous" covers seven classifications, such as telephone and telegraph poles, round mining timber, fence posts, wood for distillation, etc.

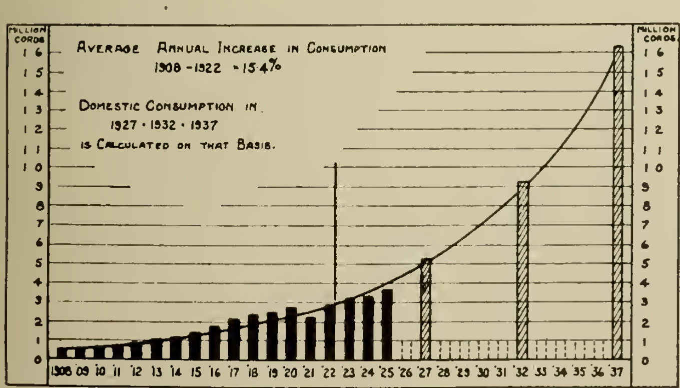


Figure No. 1.—Canada's Possible Consumption of Pulpwood for the Next Fifteen Years, from 1922, with Figures Added for 1923-4-5 Consumption.

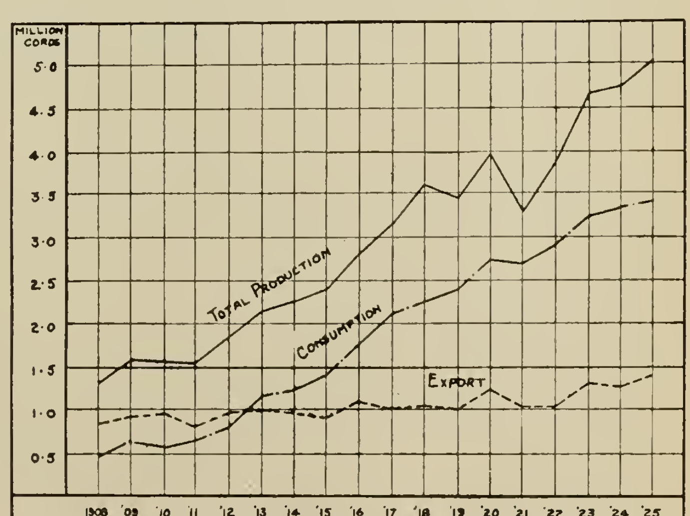
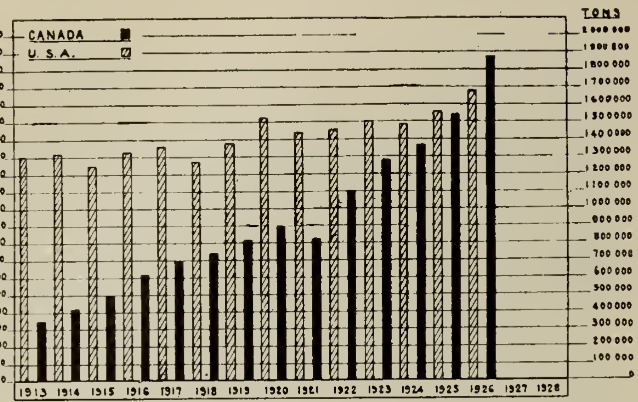


Figure No. 2.—Canadian Pulpwood Production, Manufacture and Export—1908-25.



	CANADA	U S A		CANADA	U S A		CANADA	U S A
1913	350 000	1 305 000	1918	734 783	1 260 285	1923	1 266 000	1 485 000
1914	415 000	1 283 000	1919	794 567	1 374 517	1924	1 352 994	1 470 881
1915	489 000	1 239 000	1920	883 215	1 511 968	1925	1 522 217	1 530 318
1916	608 000	1 315 000	1921	812 787	1 226 183	1926	1 874 021	1 683 600
1917	689 847	1 359 012	1922	1 086 551	1 447 688	1927		

Figure No. 3.—Newsprint Production in Canada and United States.

our wood into pulp and paper gives us eight times as much value as we would get if we used it for railroad ties; naturally, we must keep our railways supplied with ties, but the railway can do with a smaller quantity if all ties are properly treated before being used, and the quantity of wood thus saved can be more profitably utilized.

Someone connected with the paper industry will probably say that such wood as is used for ties and firewood is not suitable for pulp-making purposes. In answer to such a statement, it may be pointed out that less than twenty years ago it was not considered possible to make newsprint with more than 10 per cent balsam, whereas to-day in at least one of the large mills in North America newsprint paper of standard quality is manufactured with over 70 per cent balsam. Needless to say, the more inferior the raw material the more carefully the manufacturing process has to be controlled, but there is no apparent reason why, with adequate research and practical application of information obtained, we should not, within the very near future, utilize commercially such Canadian woods in the manufacture of fibre as are to-day considered unsuitable.

Before it is really necessary to resort to the use of inferior raw material, we could help a good deal in the profitable utilization of our wood by converting most of it into a finished product instead of exporting it in unmanufactured form.

It is pleasing to note, from the chart, (figure No. 2), showing pulpwood production, manufacture and export, that the export of pulpwood has remained relatively constant for a number of years past, and it is hoped that an effort will be made to utilize more wood in our own country so as to bring the curve to its former level.

It must not be overlooked, however, that for conversion, and especially for the manufacture of paper, power in large quantities is required. Where power and wood at reasonable prices are available, in locations which permit easy access to the markets for the finished product, undoubtedly the development for the manufacture of the finished product will continue, and thus our export of raw material will diminish by the creation of a home market for same.

During the recent past, in one of our daily papers has appeared a prominent article that the government of the province of Quebec is taking steps to restrict the construction of new paper mills in Quebec. Considerable attention was given to that article, and those who considered that the construction of paper mills was going on at too rapid a pace approved of it. Others, however, did not share the same opinion. Fortunately, however, a few lines in the papers at a later date contradicted the original article, and everyone appeared happy, but nevertheless there was left an undercurrent which may need rectification.

The engineering profession is much interested in the welfare of the Canadian paper industry, and since the province of Quebec is one of the largest producers of pulp and paper products, and, further, since the writer is more conversant with the natural resources of Quebec, (wood and power), than those of any other province in Canada, it may be appropriate to refer briefly to the article mentioned above.

From observation of the past, the policy of the province of Quebec has been to encourage the development of manufacturing within the province and to discourage the export of raw materials; since our forests contain a large amount of mature crop, it must be harvested, and since we have no desire to export the wood as raw material we must provide further manufacturing facilities.

On the assumption that the government will not restrict the construction of new mills, the further development will then be left as heretofore to the commercial requirements; and, to go a step further, the writer is of the firm belief that no government should financially assist a competitive manufacturing industry in order to have same located within its borders.

The most active development in Canada in the pulp and paper industry has been the manufacture of newsprint paper. This branch has now in Canada a daily capacity of 7,400 tons; this is 1,800 tons more per day than the United States, which until recently was the largest producer of newsprint paper in the world.

The rapid development of the newsprint industry in Canada is attributable to its favourable location to the market, and the continued and relatively steady increase in consumption of newsprint paper is shown by the chart giving production of newsprint in the United States and Canada, which shows an average increase of around 7 per cent over a long period of years.

In the past, the Engineering Institute of Canada probably has not sufficiently realized the large possibilities there

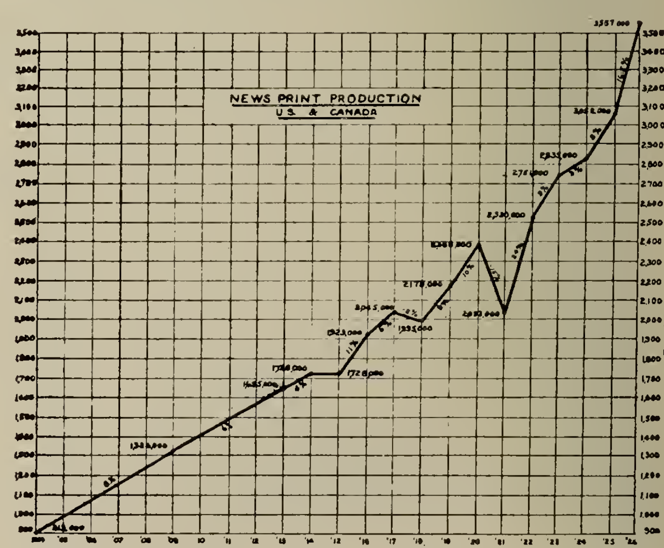


Figure No. 4.—Newsprint Production in Canada and United States.

are for its members in the pulp and paper industry of Canada, and, although some may view the future with apprehension, yet the writer is of the opinion that with some change in our methods of operations the industry will become more prosperous. However, it is essential that, as raw material becomes more expensive and competition more keen, different methods be used, and who is more qualified to develop and introduce more economical methods than the man with a scientific and practical mind, or, in other words, the engineer?

During a conversation some time ago with one of our Canadian paper mill men, who had just returned from Europe, he was very enthusiastic regarding the European methods of manufacture, and especially the economical use of raw material and utilization of by-products.

Permit me to refer to the paper on "Power Consumption in the Manufacture of Newsprint Paper," which was delivered by the writer at the monthly meeting of the Montreal Branch of The Institute held at Montreal on March 5th, 1914. During the discussion of that paper, the writer said:—

> "Paper mill machinery as constructed in Europe is of a higher grade as far as constructive details and finish are concerned, but quite often the machinery is not designed to suit American conditions, and therefore great caution is necessary in the adoption of European machinery."

It is not intended to make any comments on machinery of European origin which has been introduced into Canada since that time; the results are well known to those who are closely associated with the industry; but it will suffice to say that Canada is now producing machinery for the pulp and paper industry equally as good as made anywhere in the world, and, what is still more important, most of the machinery made in Canada is suitable for our conditions.

Our social conditions differ materially from other paper-making countries, and the writter cannot admit that our modern mills are not as economical as those located anywhere else. We produce more per man-hour, and as far as newsprint is concerned make the best and most uniform product. It is true we are not recovering by-products to the extent we should, but this is largely due to local conditions. We would have no market for such by-products as can be disposed of at a profit in Europe.

Manufacturing is largely a matter of transportation. This applies from the initial handling of the raw material through the entire manufacturing process up to the production of the finished article and its delivery; and in this we must endeavour to obtain the best results by the adoption of simple methods which require the minimum of effort, are reasonably low in first cost, and, above all, low in maintenance.

In converting our wood into fibre, whether it is done by mechanical or chemical means, we must give consideration to quality and yield of the grade of fibre which produces the best finished product. We must not measure power used in producing mechanical pulp, or chemicals used in making cellulose on the basis of wood consumed, but on the unit of acceptable fibre produced.

We may and must study processes and methods of other countries, but we cannot adopt them wholesale, as our own requirements differ for almost each individual plant. Engineers and chemists should combine more closely in the paper industry to produce the quickest, most practical and economical solution of our problems, of which there are still many.

THE

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OF CANADA

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The Problem of the Young Engineer

The Annual General Meeting of a body like the Engineering Institute of Canada, affording, as it does, a common meeting ground for engineers of all branches of the profession from all parts of the country, gives a favourable opportunity for discussing The Institute's policies and questions of the day, and reference to the programme printed elsewhere in this issue will show that time has been set apart for this purpose during the morning and afternoon sessions of the opening day of the forthcoming meeting in Quebec.

As a live question which might well occupy the attention of members at this time, the problem of the young graduate has been suggested. Much has been written, and much discussion has taken place, on the vast subject of engineering education; but the educational period of the young engineer is usually thought of as terminating when he takes his degree at the university. The fact is not always recognized that at this stage he is just beginning the most important period of his training, that he is entering the hard school of experience, and that his further development will depend very largely on the treatment he receives and the opportunities afforded to him during the first years of his employment in practical work.

It is not sufficient for the young graduate merely to succeed in obtaining some kind of employment, more or less remunerative; in his best interests, his duties should be such as to give him opportunity for useful experience and for development in the art of dealing not only with materials but also with men.

During the past year, on the proposal of Professor H. E. T. Haultain, M.E.I.C., this matter has received the attention of Council, and a brief communication regarding it is printed among the reports of the various committees to Council. So far as investigation has gone, it has shown very definitely that while engineering graduates are needed in every department of construction, production and distribution, they have much to learn on leaving the university, and are not necessarily fitted to perform in the most effective manner the work assigned to them by their first employers. This is no reproach to the graduates or engineering schools of the universities, whose province it is to lay the foundation of their students' training, a training which is continued after leaving the university by years of experience; the task of moulding the still plastic material to its most efficient form must therefore lie very largely in the hands of the employers themselves.

This gives rise to several questions; for instance, what is the attitude of the average Canadian employer towards the technical graduate? What does he do towards developing young graduates with a view of obtaining the supply of competent men necessary for his future requirements? What opportunities for further training and development does the young engineering graduate get on his entry into industrial life? Is there anything that the graduates themselves can do to help in this matter? Finally, what are the duties and powers of a body like the Engineering Institute of Canada in this connection?

The problem of the further training and development of the young technical graduate is at least as difficult as that which confronts the engineering schools of the universities, but whereas his college education has for many years received intensive study at the hands of university faculties and committees, and such bodies as the Society for the Promotion of Engineering Education, there appears to have been comparatively little organized study or investigation directed towards the difficulties of his post graduate career.

It is true that in many cases the university authorities have taken action locally to interest employers, and attention has been given to the question by branches of The Institute and by certain of the Provincial Associations of Professional Engineers, for example, in British Columbia and in Ontario. In the latter province, a very interesting attempt is now being made to bring about collective action in this matter, and to provide funds for the commencement of a campaign designed to interest the manufacturer, industrialist and prospective employer in the young technically-trained men who are being provided by the engineering schools of the province.

The importance of the subject warrants a far more general activity and interest than has so far been displayed. We are accustomed to lay stress, and rightly so, on the part played by the engineer in the development of our country, but do not think so often of the necessity of a supply of properly trained, resoureeful and experienced engineers for this work in the future.

As a first step, and as regards The Institute itself, should we not initiate discussion on this subject, first in the Annual General Meeting, and later at branch meetings throughout the country? To aid in a correct understanding of the problem, information and data will have to be studied, not only as to the attitude of the employers of the young engineers, but also as to the activities of the engineering schools in following up their graduates' careers.

A frank discussion and statement of members' opinions on this important question might well form part of the proceedings of the 1927 Annual General Meeting.

Forty-first Annual General and General Professional Meeting

Quebec City, February 15th, 16th and 17th, 1927. — Headquarters: Chateau Frontenac.

The Annual Meeting which was convened at Headquarters in Montreal on January 27th, 1927, was adjourned to reconvene at the Chateau Frontenac, Quebec City, on Tuesday, February 15th, 1927, with sessions of the Professional Meeting continuing on the two succeeding days.

The committee of the Quebec Branch, under whose auspices this meeting is being held, have done everything possible to assure the success of the meeting and a very elaborate and intensely interesting programme has been provided. A copy of the tentative programme was published on page 42 of the January issue of the Journal.

The papers to be presented at the Technical Sessions are being printed in advance, and copies are being sent to prominent engineers throughout Canada, with the result that the discussion on each of these papers will, undoubtedly, be very interesting and instructive.

Four of these papers were published in the January issue of the Journal, as follows:—"Alternating Current Electrolysis," by J. W. Shipley and Chas. F. Goodeve; "Rack Structure and Penstock Intake of the Isle Maligne Hydro-Electric Power Station," by W. S. Lee, M.E.I.C.; "Electrical Characteristics of the Quebec-Isle Maligne Transmission Line," by Clarence V. Christie, M.E.I.C., and "Water Power Developments of the Alouette-Stave-Ruskin Group of the B.C. Electric Railway Company," by E. E. Carpenter, M.E.I.C.

In the present issue of the Journal, six more of the papers are published, two dealing with the mining industry in the provinces of Ontario and Quebec and four treating of various phases of forestry. The three remaining papers scheduled to be presented are:—"Building an Industrial Plant in the Saguenay District," by John L. Guest; "Developments of the Gatineau Power Company on the Gatineau River," by J. A. McCrory, M.E.I.C., and "Protection Against Seepage at Lake Kenogami," by O. O. Lefebvre, M.E.I.C.

It will be seen from the above that the Technical Sessions have much of interest, particularly as there will be ample time for a full discussion of each paper, since the papers will be presented in abstract only.

Provision has been made throughout the programme for visits to points of interest, and included in the social events are Luncheons, the Annual Dinner, a Smoker and a Supper-dance and Bridge, with special entertainment for the visiting ladies.

Railway and Hotel Arrangements

An announcement appears on Page 58 of the January Journal regarding the special transportation arrangement and hotel rates, and a similar notice was mailed to all members of The Institute. Those expecting to attend the meeting should communicate with their Branch Secretary as soon as possible in order that transportation arrangements may be made.

Programme Revised to Date

Tuesday, February 15th.

9.00 a.m. Registration.

10.00 a.m. Reception and discussion of reports from Council, Committees and Branches. Scrutineers' report and election of officers. Retiring President's address. Induction of new President.

1.00 p.m. Lunch—complimentary to visitors. Welcome to members by Chairman of the Quebec Branch, who will preside. Brief address by the Mayor of Quebec.

1.00 p.m. Lunch for ladies.

3.00 p.m. Continuation of Annual General Meeting—unfinished and new business.

8.30 p.m. Smoker or special entertainment. (Admission by ticket.)

9.00 p.m. Theatre party for ladies.

Wednesday, February 16th.

10.00 a.m. First technical session.

Brief introductory address by the Hon. H. Mercier, Minister of Lands and Forests, Province of Quebec.

A—(Jacques Cartier Room)

Notes on the Forests of Quebec—G. C. Piché, A.M.E.I.C. Deals with questions of forest administration.

The Wood Consuming Industries of Canada—John Stadler, M.E.I.C. Has special reference to pulp and paper manufacture.

(Wednesday morning session, continued)

Woodlands Management and Operation—S. L. de Carteret, M.E.I.C.

Transportation in Pulpwood Operations—G. E. La Mothe, A.M.E.I.C. Outlines modern methods of handling wood from the forest to the mill.

B—(Private Dining Rooms 3-4-5)

Electrical Characteristics of Quebec-Isle Maligne Transmission Line — Professor C. V. Christie, M.E.I.C. Deals with the most recent large transmission line in Eastern Canada.

Alternating Current Electrolysis — Professor J. W. Shipley. Further experimental work in this interesting field.

Building an Industrial Plant in the Saguenay District—John L. Guest, A.M.E.I.C. Covers the construction problems encountered in building the works of the Aluminum Company of Canada at Arvida, Que.

Protection Against Seepage at Lake Kenogami—O. O. Lefebvre, M.E.I.C. The methods adopted to cope with a difficult situation.

2.00 p.m. Visit to Quebec Bridge or St. Malo Shops.

7.30 p.m. Annual Dinner of Institute. (Admission by ticket.) President in the Chair. Addresses by Sir Henry Thornton, M.E.I.C., and other prominent speakers.

7.30 p.m. Dinner for ladies.

(Programme continued on next page)

Thursday, February 17th.

10.00 a.m. Second technical session.
(Jacques Cartier Room)

Design and Construction Features of Rack Structure and Penstock Intake for Isle Maligne Station of Duke-Price Power Company, Limited, on Saguenay River, Province of Quebec, Canada—W. S. Lee, M.E.I.C. Data regarding a vital portion of this important development.

The Water Power Developments of the Alouette-Stave-Ruskin Group—E. E. Carpenter, M.E.I.C. Describes an interesting group of hydro-electric plants in British Columbia.

Developments of the Gatineau Power Company on the Gatineau River—J. A. McCrory, M.E.I.C. Data regarding the three installations at Farmers, Chelsea and Paugan, with notes on some special features of design.

2.00 p.m. Third technical session.

Brief introductory address by the Hon. J. E. Perrault, Minister of Colonization, Mines and Fisheries, Province of Quebec.

Notes on the Ore Deposits of Western Quebec—Theo C. Denis. Deals with the geological relations of the new goldfields.

The Metal Mining Industry of Northern Ontario—W. R. Rogers, A.M.E.I.C.

Discussion of papers previously presented.

5 p.m. to 7 p.m. Ladies will be entertained at tea.

8.30 p.m. Supper-dance and Bridge in Ball Room. (Admission by ticket.)

Meeting of Council

Meeting of January 18th, 1927

A meeting of Council was held at eight p.m. on Tuesday, January 18th, 1927, Vice-President K. B. Thornton, M.E.I.C., in the chair and four members of Council being present.

The draft report of Council for the year 1926 and the annual reports of the various committees of The Institute were considered and approved.

The reports of the various branches were received and approved for presentation at the Annual Meeting.

The list of representatives of the various branches on the Nominating Committee for the year 1927 was noted and approved.

A report from the Legislation and By-laws Committee on the proposed by-laws for the Winnipeg Branch was submitted and approved.

The list of officers of the Victoria Branch for the year 1927 was submitted and approved.

The secretary reported that in accordance with the directions of a previous meeting of Council a letter had been addressed to Mr. F. B. Brown, secretary of the Corporation of Professional Engineers of the province of Quebec, requesting him to communicate with the governing bodies of the various provincial associations of Professional Engineers, with a view of initiating discussion as to the best method to be adopted to bring about substantial uniformity in the requirements for admission by examination to the several provincial associations and to The Institute; that Council's request would be complied with.

Mr. C. A. Price, assistant chief engineer of the Canadian Westinghouse Company, Limited, Hamilton, was appointed a member of the Canadian National Committee of the International Electrotechnical Commission.

Ten special cases were given consideration; three requests for reinstatement were considered and approved, and thirty resignations were accepted.

The following elections and transfers were effected:—

Elections		Transfers	
Member	1	Associate Member to Member	4
Associate Member	1	Junior to Associate Member	2
Juniors	2	Student to Associate Member	4
Students	5	Student to Junior	1

Sixteen applications for admission and transfer were scrutinized and classified for the ballot returnable March 21st, 1927.

Ten special cases were considered in connection with applications for admission.

The Council rose at ten-thirty o'clock p.m.

Publications of Other Engineering Societies

As previously announced in the Journal, an exchange arrangement exists between the Engineering Institute of Canada and the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers and the American Society of Mechanical Engineers.

Subscriptions may be sent either directly to New York or through Headquarters. The following list of rates gives in the first column the amounts payable by members of the Engineering Institute for the various publications:—

	Rate to Members	Rate to Non-Members
American Institute of Electrical Engineers		
Journal, single copies	$0.50	$ 1.00
" per year	5.50	10.50
Transactions, per year, paper	5.00	10.00
" " " cloth	5.00	10.00
Year Book	1.00	2.00
Pamphlets	.25	.50
American Institute of Mining and Metallurgical Engineers		
Magazine, single copies	0.50	1.00
" per year	5.00	10.00
Transactions, per volume, with pamphlets, paper	2.50	5.00
(Other publications, same rate E.I.C. members as to A.I.M.M.E. members.)		
American Society of Civil Engineers		
Proceedings, single copies	0.50	1.00
" per year	4.00	8.00*
Transactions, " "	6.00	12.00†
Year Book	1.00	2.00
(Other publications 50 per cent reduction on catalogue price to E.I.C. members.)		
American Society of Mechanical Engineers		
Journal, single copies	0.50	0.60
" per year	4.00	5.00
Transactions, per year	6.00	8.00
Year Book	1.00	2.00
(Other publications, same rate to E.I.C. members as to A.S.M.E. members.)		

**If subscription is received before January 1st, otherwise $10.00.*

†If received before February 1st, otherwise price $16.00.

OBITUARIES

William Russell Russell, M.E.I.C.

In the death of William Russell Russell, M.E.I.C., which occurred at Quebec, Que., on October 5th, 1926, the civil engineering profession in Canada has lost one of its widely known and highly esteemed members.

The late Mr. Russell was a native of Peterborough, Ont., where he was born on February 16th, 1859. His early education was received at the public schools of Kirkfield and Toronto and at the Toronto Model School. He was later an articled pupil of the late Mr. John C. Bailey, civil engineer of Toronto.

With the exception of four years, from 1904-08, when he was in Arizona, his entire engineering work has been in connection with railway construction, operation and maintenance. As early as 1879 he was assistant engineer on what was then known as the Victoria Railway, and between that time and 1883 he occupied the same position with the Credit Valley Railway and Midland Railway, all of which were in the province of Ontario. In 1883 he was appointed to the same position with the Quebec and Lake St. John Railway and six years later was made chief engineer and general superintendent of the Quebec, Montmorency and Charlevoix Railway. In 1901 he became general superintendent of the Great Northern Railway of Canada, later the Canadian Northern Railway, and three years later was engaged in the construction of the Ottawa and Gatineau Valley Railway. From 1904 to 1908 he was located in Arizona as chief engineer and general superintendent in connection with a number of mining companies in that country. Returning to Canada in 1908, he became engaged as divisional engineer on the National Transcontinental Railway. At the time of his death he was a member of the engineering staff of the Quebec Harbour Commission.

The late Mr. Russell joined The Institute in the first year of its incorporation, being elected Member on October 6th, 1887. Subsequently he discontinued his membership and was re-elected Member on April 9th, 1910.

Eric Charles Hutchinson, A.M.E.I.C.

It is with regret that we record the death of Eric Charles Hutchinson, A.M.E.I.C., which occurred at Ottawa, Ont., on December 17th, 1926, following a short sickness from typhoid fever.

At the time of his death, Mr. Hutchinson was on the staff of the Fraser-Brace Engineering Company, Limited, and had been engaged in connection with the power development on the Gatineau river.

The late Mr. Hutchinson was born at Vevey, Switzerland, on October 11th, 1896, and was a graduate in civil engineering of Ecole Polytechnique Fedorale Suisse, Zurich, of the year 1920, and coming to Canada he became connected with the Duke Price Power Company in August, 1924, in a junior engineering capacity, and in October of the same year joined the staff of the Wm. I. Bishop Limited, in connection with the construction of the Riverbend mill for Price Brothers and Company, Limited. In October, 1925, he entered the employ of the Fraser-Brace Engineering Company, Limited, as designing engineer on the Chelsea power development, subsequently becoming chief of an engineering party on the Farmers development of the Gatineau Power Company with the Fraser-Brace Engineering Company, Limited.

The late Mr. Hutchinson was elected Associate Member of The Institute on June 15th, 1926.

Heber William Dawson, A.M.E.I.C.

Sincere regret is expressed at the death of Heber William Dawson, A.M.E.I.C., which occurred at Ste. Anne de Bellevue hospital, Ste. Anne de Bellevue, Que., on January 4th, 1927.

Mr. Dawson was born in Montreal on December 6th, 1892, and was the son of Dr. W. Bell Dawson, M.E.I.C., of Ottawa. He received his early education at Trinity College school, Port Hope, and the Ottawa Collegiate Institute, and entered the engineering course at McGill University in 1911, but owing to the War he did not complete his course until after his return from overseas, receiving his degree of B.Sc. in 1920.

Shortly after the outbreak of war he proceeded overseas with the Canadian Engineers as lieutenant and due to

HEBER WILLIAM DAWSON, A.M.E.I.C.

his knowledge of wireless telegraphy he was attached to the Signal Corps.

Throughout the war he was with the Canadian Expeditionary Force in the Somme and Armentieres regions, and attained the rank of captain. On his return to civilian life, he joined the engineering staff of the Shawinigan Engineering Company, Limited, in May, 1920, and was still connected with that company at the time of his death. During that time he was engaged on electrical design in connection with some of the most important developments, among which were the 41,000-h.p. unit installed at Shawinigan Falls, the Great Falls development of the Manitoba Power Company, the La Gabelle development of the St. Maurice Power Company and the St. Narcisse development of the North Shore Power Company.

While the late Mr. Dawson had not been in good health for some two months prior to his death, the news of his death came as a great shock to his many friends both in the profession and private life. He was an active member of the Engineering Institute of Canada, having been elected Student on December 21st, 1920, and transferred to Associate Member on June 15th, 1926.

PERSONALS

E. Gray-Donald, S.E.I.C., who graduated from McGill University in 1926, is at present with the Quebec Power Company and is located in Quebec city.

C. R. Davis, S.E.I.C., who graduated from the University of Toronto in 1923, has accepted a position with the Massey-Harris Company, Limited, in Toronto, Ont.

H. W. Perkins, A.M.E.I.C., is resident engineer with the State of Minnesota, Department of Highways, and has been transferred from Ada to Detroit Lakes, Minnesota.

J. M. Campbell, S.E.I.C., of Vancouver, B.C., who has recently completed the graduate students' course with the Westinghouse Electric and Manufacturing Company, has accepted the position as assistant district manager with the Central Mexico Light and Power Company at Irapuato.

F. H. Job, Jr.E.I.C., formerly with the Koppers Construction Company at Pittsburgh, Pa., has resigned to accept a position with the Blaw Knox Company, Blawknox, Pa. Mr. Job was on the staff of the Hamilton Bridge Works Company, Limited, for a number of years prior to going to Pittsburgh.

Alphonse Bleau, S.E.I.C., has been appointed instructor in chemistry and French at the Royal Military College of Canada, Kingston, Ont. Mr. Bleau received his degree of B.Sc. from McGill University in 1923, and was for a time engaged in building construction, following which he was inspector of construction for the Montreal Water Board.

Lt.-Col. W. G. Tyrrell, M.E.I.C., is proceeding to Bombay, India, where he has been appointed in command of the Royal Engineers, his address being C.R.E. Office, Bombay, India. Colonel Tyrrell served with distinction through the great war with the Railway Branch of the Royal Engineers, and in addition to receiving the D.S.O., was mentioned twice in despatches. Col. Tyrrell was born at Port Rowan, Ont., on June 6th, 1882.

J. Henri Valiquette, A.M.E.I.C., city manager of Shawinigan Falls, Que., has resigned to accept the position of assistant to the managing director of the Anticosti Corporation. Mr. Valiquette is a graduate of Ecole Polytechnique, from which he received the degree of B.A.Sc. in 1907. Prior to his appointment as city manager of Shawinigan Falls in 1920, he was assistant engineer in charge of the Department of Surveys and Design of the city of Montreal.

D. E. O'Brien, M.E.I.C., senior assistant engineer in charge of section 2 of Welland ship canal, has been transferred to section 6 at Welland, Ont., in the same capacity. Mr. O'Brien is a graduate of the University of Toronto of the year 1905 and first joined the staff of the Welland ship canal in 1913, where for five years he was assistant engineer on section 2. In 1918 he became chief engineer of the Halifax Ship Yards at Halifax, N.S., where he remained until 1921, when he was appointed to the position which he now holds.

Edgar V. Gilbert, Jr.E.I.C., who has for some time been located at Hemming's Falls, Que., on the engineering staff in connection with the hydro-electric power development of the Southern Canada Power Company, Limited, has moved to Maniwaki, where he is with the Foundation Company of Canada, Limited, on the construction work which that company is doing on the development of the Gatineau river for the International Paper Company. Mr. Gilbert graduated in civil engineering from McGill University in 1923 and following graduation was for one year with the Robert W. Hunt and Company in Montreal.

J. H. Summerskill, A.M.E.I.C., is at present on the engineering staff under the director of engineering of the B. F. Goodrich Company at Akron, Ohio. Prior to accepting this position, Mr. Summerskill was connected with the E. G. Woolfolk Company of New York city, with which company he was associated with D. D. Kimball, heating and ventilating engineer, representing the former in Columbus, Ohio. Mr. Summerskill is a graduate of McGill University, having received his degree in electrical engineering in 1914 and in mechanical engineering in 1915, and was for a number of years with the Riordon Company, Limited, first in Mattawa and later at the head office in Montreal.

C. B. R. Macdonald, A.M.E.I.C., has written advising he is moving from Peru to Brazil and that his future address will be c/o San Paulo Railway Survey, Caixa "C," Sao Paulo, Brazil. Mr. Macdonald was engaged on the construction of a narrow gauge railway at Lobitos in the northern part of Peru, and on the completion of that work in July last, he was moved to Arequipa, Peru, on the location survey of a branch of the existing Southern Railway of Peru to the Borax deposits of the Borax Consolidated. His new work in Brazil will be in connection with railways. Mr. Macdonald received his diploma with honours from the Royal Military College of Canada in 1914, and after serving overseas he returned to Canada and was engaged on construction work at Niagara Falls, Ont., for the Hydro-Electric Power Commission of Ontario.

Vice-President of Ontario Professional Engineers

Lt.-Col. A. D. Le Pan, A.M.E.I.C., superintendent, University of Toronto, has been elected vice-president of the Association of Professional Engineers of Ontario.

Col. Le Pan is a native of Owen Sound, Ont., and is a graduate of the University of Toronto, from which he received the degree of B.A.Sc. in 1908. His first work after graduation was as assistant on the filtration plant and reservoir for the town of Owen Sound. Subsequently he was engaged on various works at the University of Toronto. He was appointed assistant superintendent of the university in 1910; general superintendent in 1915; and superintendent in 1920, which latter position he still holds.

President of Professional Engineers of Ontario

A. B. Cooper, M.E.I.C., general manager, Ferranti Electric, Limited, Toronto, has been elected president of the Association of Professional Engineers of Ontario.

Mr. Cooper is a graduate of Tufts College, from which he received the degree of B.S. in electrical engineering in 1903. Following graduation he spent two years with the General Electric Company at Schenectady, N.Y., in the testing department, and two years with the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. In 1907 he was appointed assistant electrical engineer in charge of power house electrical construction with the Rio de Janeiro Light and Power Company, and in 1909 he was appointed engineer of the transformer sales department of the General Electric Company at Schenectady, N.Y. In 1913 he moved to Toronto as transformer engineer with the Canadian General Electric Company, which position he held until joining the Ferranti Electric, Limited, formerly the Ferranti Meter and Transformer Manufacturing Company.

J. E. Underwood, A.M.E.I.C., Elected Alderman

J. E. Underwood, A.M.E.I.C., of J. E. Underwood and Associate Engineers, Saskatoon, Sask., has recently been elected alderman of the city of Saskatoon. Mr. Underwood's decision to enter the political arena is said to have been the result of his having attended a meeting of the local branch of The Institute, at which President Geo. A. Walkem, M.E.I.C., addressed the members and dealt at some length with the necessity of having engineers take a more prominent part in municipal, provincial and federal affairs.

In this election, which was keenly contested, Mr. Underwood, who was practically unknown to the general public, headed the poll, and in a letter to President Walkem, Dean C. J. Mackenzie, M.E.I.C., of the University of Saskatchewan, says that during the campaign he was amazed at the evidence of esteem with which the engineer is regarded by the general public, and quotes numerous people as having said, "I don't know who this man Underwood is, but if he is a successful engineer he certainly will be a more valuable man on our council than most of those other candidates."

Mr. Underwood was born at Wroxeter, Ont., on November 3rd, 1882. He received his primary education at the high school in Hamilton and later graduated from the Faculty of Applied Science of the University of Toronto. Following graduation he was engaged on survey work for a number of years and was commissioned a Dominion Land Surveyor.

A. T. Spencer, A.M.E.I.C., joins Montreal Tramways

A. T. Spencer, A.M.E.I.C., has been appointed general superintendent of construction and maintenance for the Montreal Tramways Company. Previous to his present appointment he was assistant to the general manager of the Toronto Transportation Commission, of Toronto.

He was born at Port Morien, N.S., on February 18th, 1876, and received his primary and technical education in that province. He commenced his engineering work in 1901 with the Dominion Coal Company and the Sydney and Louisburg Railway, Glace Bay, N.S., in various capacities in connection with surveys, construction and mining work for these companies. From 1905 to 1907 he was transitman and chief of party for the Canadian Pacific Railway on grade revision surveys in New Brunswick, Quebec and Ontario.

In 1907 he joined the Montreal Park and Island Railway as special engineer in charge of surveys, and later the construction of certain suburban electric railway extensions. From the following year he was assistant engineer with the Montreal Street Railway and its successor the Montreal Tramways Company in the way and structures department until February 1921, when he joined the staff of the Railway Department of the Hydro-Electric Power Commission of Ontario as assistant engineer. In May of the same year he was appointed engineer of way for the Toronto Transportation Commission, and was in charge of the extensive rehabilitation and extension programme of trackwork done on the Toronto system from 1921 to 1923, and from April 1924 until accepting his present appointment he held this position from which he has recently resigned.

Brig.-General C. H. Mitchell heads Toronto Board of Trade

Brig.-General C. H. Mitchell, C.B., C.M.G., D.S.O., C.E., LL.D., D.Eng., M.E.I.C., Dean of the Faculty of Applied Science, University of Toronto, and consulting engineer, was recently elected by acclamation to the presidency of the Toronto Board of Trade. The Toronto Board of Trade, which at present has a membership of 3,000, has been in existence for eighty years. The election of General Mitchell to the presidency marks the first occasion on which the Board has chosen an engineer for its highest office.

General Mitchell was born at Petrolia, Ont., on February 18th, 1872. He graduated from the University of Toronto with the degree of B.A.Sc. in 1892, and received his degree of C.E. from the same university in 1898, and the honorary degrees of LL.D. (Tor.) in 1919, and D.Eng., (N.Y.) in 1922.

His engineering practice has been largely in hydraulic and hydro-electric power work and in addition to being retained as consulting engineer in design and construction of plants in various provinces in Canada and in an advisory capacity by the federal government, he has been engaged as arbitrator and expert witness in various technical and legal cases and as consultant in industrial and development undertakings. He was appointed dean of the Faculty of Applied Science of the University of Toronto in July, 1919. In 1920 he was appointed by the government of Ontario on the Royal Commission to report on the radial railways. In 1924 he was appointed by the Dominion Government on the Joint Board of Engineers to study and report on the St. Lawrence waterway project.

General Mitchell is a member and has had the office of president and vice-president in a large number of clubs

BRIG.-GENERAL C. H. MITCHELL, M.E.I.C.

and societies. He served as councillor on the Council of The Institute during the years 1908-1909 and as vice-president from 1920-1923 inclusive.

W. Nelson Smith, M.E.I.C., engaged on Valuation in Philadelphia

W. Nelson Smith, M.E.I.C., who for more than eight years has been actively engaged in engineering work in Winnipeg and Vancouver, has returned to the United States and is now temporarily engaged on a valuation of the Philadelphia Electric Company's property at Philadelphia, Pa.

While in Winnipeg, Mr. Smith was consulting electrical engineer of the Winnipeg Electric Company, and assumed the technical responsibility involved in the settlement of a long-standing electrolysis controversy between that company and the city of Winnipeg. He utilized the three-wire system of trolley distribution to reduce average track-potentials to negligible values, and subsequently (in collaboration with Dr. J. W. Shipley of the University of Manitoba) carried on research work with a view to establishing the fact that underground pipes of cast iron and lead are inevitably liable to external corrosive attack by solutions of alkaline salts of various kinds which permeate the soils in which they are buried, whether stray currents are present or not. A report of this work was presented to The Institute in 1921 and 1922, published in the Journal, for which the authors were awarded the Plummer Medal in 1923.

Besides the foregoing, Mr. Smith conducted several valuations for the Winnipeg Electric Company, also designed two substations, several improvements in the standby steam plant, salvaged over $200,000 worth of supposedly obsolete machinery and worked out various other special economic problems for the company. In 1923 he presented two more papers to The Institute, one on the three-wire trolley distribution above mentioned and the other on the economics of the Hudson Bay Railway project from the viewpoint of the Canadian taxpayer.

His work in Vancouver comprised several engagements with the Sydney E. Junkins Company, Limited, on the determination of power sites and general economics, in the course of studies and reports made by that company, for the project of electrifying the mountain subdivision of the Canadian Pacific Railway, further supplemented in 1926 by an economic study of the Diesel-electric locomotive.

J. L. Allison, m.e.i.c., joins Messrs. H. G. Acres and Company

J. L. Allison, m.e.i.c., has recently become associated with H. G. Acres and Company, Limited, consulting engineers, of Niagara Falls, Ontario, as hydraulic engineer.

Mr. Allison is well known among the engineers in Canada, and has been for many years a member of The Institute. He is also a member of the Corporation of Professional Engineers of Quebec, and an associate member of the Institution of Civil Engineers of Great Britain. As hydraulic and designing engineer for Messrs. Ross and Holgate, and later for Henry Holgate, m.e.i.c., he prepared the plans and supervised the construction of many of the larger hydro-electric projects in the Dominion, including such works as those of the Canadian International Nickel Company in Ontario, the West Kootenay Power Company in British Columbia, as well as several important installations in the province of Quebec.

During this period Mr. Allison also carried out the original studies for the great Cedars Rapids development on the St. Lawrence river, and in connection with this study prepared the original plans for the single runner vertical unit scheme of installation which was ultimately adopted.

As designing engineer for Wm. I. Bishop, Limited, Mr. Allison handled a considerable range of engineering work, including such items as the large reinforced concrete dam constructed by the Bishop Company on the Junction river for the Newfoundland Pulp and Paper Company, and the wood-handling plant of the St. Regis Paper Company at Godbout, Quebec.

Previous to becoming associated with H. G. Acres and Company, Limited, Mr. Allison was for eighteen months specially retained as a designing engineer by the Department of Railways and Canals of Ottawa to assist D. W. McLachlan, m.e.i.c., chairman of the Canadian section of the International Board of Engineers investigating the improvement of St. Lawrence river for navigation and power. In this capacity Mr. Allison prepared studies and designs for power installations on the St. Lawrence river between

J. L. ALLISON, M.E.I.C.

lake Ontario and Montreal, aggregating about 4,000,000 horse power of installed capacity.

Mr. Allison will make his permanent headquarters in Montreal as resident manager of the newly established branch office of H. G. Acres and Company, Limited, in the Canadian Pacific Express building.

CORRESPONDENCE

Allegheny Ice Gorge

Montreal, January 14th, 1927.

The Editor (*The Engineering Journal*)

Dear Sir:—

In reference to my work on the Allegheny ice gorge last March, on which John Murphy, m.e.i.c., comments in the January issue of this Journal, I am surprised to find that Mr. Murphy has apparently completely missed the point of my plan of work in the Allegheny valley.

Ice fighting is a military campaign and must be carried out as such to achieve success. My whole work was preparing for the oncoming of mild weather to obtain as much assistance from the sun as possible without allowing the sun to take the gorge out in the usual way with high levels and floods from the upper end first. Hence during the cold weather I was busy clearing out the channels under the ice and getting enough water down to the lower end of the gorge to float it successfully.

I had, therefore, to plan the entire work so that the ice would not be set in motion until conditions were such that it would pass easily through the restricted channels downstream. This was accomplished successfully and I had the entire gorge moving slowly downstream in a week's time, even during the cold weather, but I had to be careful to restrict the work to the lower end, for much damage could have resulted from the possible oncoming of mild weather and rain. Always, I stood by with my ear turned to the weather committee ready to change the plan of action at the slightest warning.

Far from not assigning due credit to the sun and rain, as Mr. Murphy suggests, I give abundant credit to these agencies, as I tried to make clear in my paper. What I had to watch was that the sun and rain did not get ahead of me and cause tremendous floods and damage in the valley before the lower end of the gorge was weakened and in a condition to move.

My operations were entirely guided by the reports of my weather committee from whom I received frequent advice and forecasts. The chart published by Mr. Murphy contains nothing that I had not already on file at the time.

Howard T. Barnes, m.e.i.c.

BOOK REVIEWS

Art de l'Ingénieur et Métallurgie

Tables Annuelles de Constantes et Données Numériques

Gauthier Villars et Cie, Paris, 1926. Edited by L. Descroix, 8½ x 10¾; pages 1660 to 1908. Price, 75 frs. paper; 90 frs. bound, plus 40% in each case.

The tables of annual constants prepared under the auspices of the Conseil International des Recherches are of importance, and this volume of engineering and metallurgical data amply maintains the reputation of the previous issue published in 1922.

The committee responsible for the preparation of the work is under the patronage of the Iron and Steel Institute, the Institute of Metals, the Council of Scientific and Industrial Research, the American Society of Mechanical Engineers, the Comité des Forges, and the Société d'Encouragement pour l'Industrie Nationale. The information presented is of great service to scientific and practical workers, and includes, as regards engineering, the several mechanical constants for a great variety of materials in common use for structural and other purposes, also the thermal constants of refactory materials and fuels. In the section devoted to metallurgy, various technical data concerning metals and alloys, their mechanical constants, and electrical and magnetic properties are included.

Such a compilation as this involves the collection of fundamental data from all sources, and places in readily accessible form those new or improved measurements and determinations of the physical qualities of the materials we use, which are constantly being made by research workers in all parts of the world. Such data are originally published in various countries and in various forms, and are in many cases apt to escape the notice of those who could really benefit by them.

The kind of information contained in the volume under review will be indicated by naming a few of the items, taken at random, such as: the strength of high silica Portland cement, the wear of concrete road aggregates, the strength of artificial and natural silk, the influence of increasing temperatures of vulcanization on preparation of rubber, the effect of fittings on flow of fluids through pipe lines, the carbonization of coals at low temperatures, the thermal and electrical conductivity of iron-cobalt alloys, the melting points of tungsten steels, the corrosion of steel containing copper, and many electric and magnetic constants.

The whole forms a valuable work of reference.

Transmission Line Theory and Some Related Topics

By William S. Franklin and Frederick E. Terman. Franklin & Charles, Lancaster, Penn., 1926. Cloth, 5¾ x 8½ in., 312 pp., diagrs.

The recently published book "Transmission Line Theory," by Franklin and Terman, is a valuable addition to the rapidly growing number of works of reference on this important branch of electrical engineering. The authors throughout the work have not contented themselves with the mere statement of formulae and the methods of applying them but, as the name implies, have gone right back to the basic underlying mathematical and physical theory. This they have developed in a lucid and logical way into the form in which it may be put to practical use. No one but an experienced teacher could have written as clearly on the many intricate subjects involved in such a work.

Commencing with the discussion of the solution of the types of differential equations involved, the first chapter deals with the subject of non-periodic waves, their travel along the line and reflection from the open and short circuited ends as well as from the end when closed by an impedence. The distortionless line is also discussed.

The following chapter deals with the harmonic wave in a similar manner.

The equations for the long line in the steady state are developed in the third chapter and the three-phase line is discussed in the chapter following, which includes also an exposition of the circle diagrams of both generator and receiver ends of the line and the various loci which they may include.

Artificial lines and wave filters and their design are discussed in chapter V, which completes the first part of the book.

The two chapters of the second part are devoted to the Fourier series and to non-harmonic waves of electromotive force and current.

In each chapter there is included a series of well thought out examples with answers to illustrate the principles which have been discussed, and appendices are added at the end of the volume on subjects which include corona loss, simple transients, the algebra of complex quantities, hyperbolic charts and their use in solving the problems of long transmission lines, etc.

The book is not designed as a hasty reference for the busy engineer, but rather as an exposition of the why and the wherefore of the methods and formulae which are in common use.

E. P. Fetherstonhaugh, M.E.I.C.

ELECTIONS AND TRANSFERS

At the meeting of Council held on January 18th, 1927, the following elections and transfers were effected:—

Member

BRIDGLAND, Morrison Parsons, B.A., (Univ. of Toronto), i/c Calgary Office, Topographical Survey of Canada, Calgary, Alta.

Associate Member

GUEST, John Laurence, B.Sc., (Va. Military Institute), C.E., (Cornell), Office engr. Aluminum Co. of Canada, Ltd., Arvida, Que.

Juniors

CRAIG, Shirley Abbott, B.Sc., (McGill Univ.), student engrg. course, Can. Westinghouse Co. Ltd., Hamilton, Ont.

PATTERSON, Elmer Goodwin, B.Sc., (Queen's Univ.), asst. to res. engr., Can. Int. Paper Co., Gatineau, Que.

Transferred from class of Associate Member to Member

FOSNESS, Arthur Williams, E.M., (Univ. of Minn.), ch. engr. for Carter-Halls-Aldinger Co., Winnipeg, Man.

McNAUGHTON, Andrew George Latta, B.Sc., M.Sc., (McGill Univ.), Deputy Chief of the General Staff, Ottawa, Ont.

SHERMAN, Norman Clarence, ordnance mech. engr., mech'l. engrg. branch, Dept. of Nat. Defence in Inspection Dept., Esquimalt, B.C.

YUILL, Alexander Claude Roy, consulting engr., Vancouver, B.C.

Transferred from class of Junior to that of Associate Member

BOWMAN, Nelson, B.A.Sc., (Univ. of Toronto), ch. engr., Dom. Linseed Oil Co., Baden, Ont.

CUNNINGHAM, Adam, B.Sc., (Univ. of Edinburgh), asst. to mech. supt. at Riverbend Paper mill of Price Bros. & Co. Ltd., Riverbend, Que.

Transferred from class of Student to that of Associate Member

FENWICK, James Reid, B.Sc., (Univ. of Toronto), i/c design work on radio receiving equipment for Northern Electric Co., Montreal, Que.

LAURENDEAU, Camille Thomas Joseph, C.E., B.A.Sc., (Univ. of Montreal), valuator and supervisor of tech. dept., Title Guarantee and Trust Corp. of Canada, Montreal, Que.

VALLIERES, Irenee A., B.Sc., (Ecole Polytechnique), asst. engr. grade 1 with tech. service, city of Montreal, Que.

Transferred from class of Student to that of Junior

SIMPKIN, Douglas Benjamin, B.Sc., (Univ. of Alta.), struct'l dftsman, Braden Copper Co., Rancagua, Chile, S.A.

Winter in Canada

The Natural Resources Intelligence Service of the Department of the Interior, Canada, has issued an interesting booklet entitled "Winter in Canada," which is one of the series of tourist booklets being issued by that service.

Map of Sullivan Lake Area

The Topographical Survey, Department of the Interior, Ottawa, has issued another of the series of topographic maps forming part of the sectional map of Canada. The new map is known as the Sullivan Lake sheet and covers an area of about four thousand square miles, extending to the eastern boundary of Alberta to range 14 inclusive, west of the fourth meridian and from township 33 northerly to township 40.

ABSTRACTS OF PAPER

Mercury Mines of Almaden, Spain

Dr. E. L. Bruce, Mineralogy Department, Queen's University. Kingston Branch, December 10th, 1926.

Mercury is unique among metals in that it is the only one which is liquid at ordinary temperatures. This characteristic prevents its use as a constituent of alloys, and hence, it is the only metal the use of which is not increasing. It is possible that a large demand could be created were mercury less expensive but it ranks as one of the rarer elements and the cost of production will probably always render it unavailable for purposes such as the mercury turbine. Not only are new uses for any large amount not being developed but the mining industry, formerly the largest consumer, has, by the development of the more efficient cyanide method for gold extraction, largely ceased to use mercury. Once again the largest single use has become the ancient one as a pigment.

In spite, however, of a stationary or decreasing demand the price of the metal remains practically constant. This is due to the fact that most mercury deposits carry only a small percentage of the element, that the output of the one known rich deposit is under government control.

By far the largest and richest known occurrence of cinnabar, the one ore of mercury, is at Almaden in the province of Cuidad Real in the southern part of Spain. The history of mining at that locality goes back at least to 332 B.C., when the mines were operated by the Carthaginians. During the early part of the Christian Era cinnabar was exported to Greece and Rome to produce the vermilion reds for the artists of those cities. The labour involved in mining the material by the means then available, in transporting it a considerable distance by land and then by sea, shows the value placed upon it in ancient times.

Following the fall of the Roman Empire, it is unlikely that the mercury mines were worked during the three centuries of Gothic dominance of Spain, but with the conquest of Spain in 712 by the Moors, the Almaden mines were again exploited and the working methods improved. Moorish occupation of New Castille was ended in 1151 by the victories of Alfonso VII, but the provinces to the south were held for much longer. The mercury mines were entrusted first to the Templars, who were not able to protect them from the Moors, and later to the order of Calatrava. In 1348 they were proclaimed state property but were leased to the order of Calatrava until 1525 when Emperor Charles I ceded the mines to James and Marcos Fuggar to whom he was indebted, a royalty being paid the Crown. In 1647 this arrangement was terminated and Don Juan Bustamente, an engineer of great ability, was made superintendent. Under his management both mines and retorting plant were put on an efficient basis. Production continued steadily until the latter part of the 18th century, when German engineers, who had been placed in charge of mining operations, failed to maintain a proper reserve of ore and production was severely curtailed.

Normal conditions were again reached only about the beginning of the Napoleonic wars, and, due to disturbances following them, the mines were entirely closed from 1817 to 1825. Again during the Carlist disturbances of 1835 to 1838 production was interfered with, conditions becoming stable again about 1868.

In 1904 a period of modernization began. At present, installation of new equipment is not complete and in the retorting of the cinnabar the ancient furnaces of Bustamente are being used side by side with a very modern plant for volatilization.

The geological history of this part of Spain contains several lost intervals, so that the period of ore formation cannot be fixed with accuracy. The earliest rocks are a series of sandstones, shales and limestones found in early Paleozoic times, during the submergence of most of the Iberian peninsula. Later, probably in the carboniferous, powerful north-south thrusts threw the sediments into east-west trending folds and metamorphosed the sandstones to quartzites. At the same time came intrusions of granites along the axes of some of the folds. The area then became a land surface, and normal erosion truncated the folded beds, leaving the granite cores standing out as mountain ranges. Sedimentation during the Tertiary period covered all the early rocks with marls and sands. These are still practically flat lying in central and southern Spain but are closely folded and intruded by granites in the Pyrnees mountains, which are uplifted by the south-west north-east compression of the Alpine revolution. It is thought possible that the ore deposits belong to this period.

The cinnabar is believed to have been given off from some intrusive body during cooling and to have impregnated the porous quartzite beds lying above the igneous mass. Since the Alpine period of mountain building the peninsula has been mostly a land area undergoing continuous weathering and removal of its surface formations.

The topography of the southern and central part of Spain depends upon the stage which the removal of the flat-lying Tertiary beds has reached. The ancient mountains formed by the east-west masses of granite are again exposed. The Guadarrama mountains lie north of Madrid, the mountains of Toledo south of Toledo and the Sierra Morena still further south. Between the first two ranges the Tagus river flows westward. The Guadiana river follows a parallel course between the two southern ranges. The character of these two river valleys is decidedly different. In the valley of the Tagus the flat-lying Tertiary beds have not been removed to a depth sufficient to expose the underlying folded rocks. Hence the country is comparatively flat with mesa-like elevations where some harder bed has resisted erosion and has protected the soft beds beneath it. This is the high plain of Old Castille below which the rivers have cut broad valleys.

South of the mountains of Toledo the younger rocks have been practically completely removed and the old folded rocks exposed. Steep-sided parallel ridges have developed on the hard quartzites and the softer rocks form the intervening valleys. The main streams do not occupy these valleys but in general cut across the formations quite without regard to the structure, excepting that the stream valleys are narrow gorges where they pass through the quartzite ridges. Evidently the streams were formed originally on the flat-lying beds that once covered the whole region and, as these were gradually removed, the streams held their courses and cut down through the ridges to their present level. The net result is a monotonous mesa topography in Old Castille and a rugged and diversified topography with steep-sided ridges and many narrow gorges in New Castille.

The deposits of cinnabar at present being mined average about 7 per cent of mercury, which is much higher than the grade of any other known deposit. Three main lodes are being mined. They consist of portions of quartzite beds in which cinnabar has filled the cracks in the rock and the interstices between the grains of quartz. Widths as great as 36 feet have been mined and, in places, ore of extremely high grade has a width of 20 feet. In this ore the impregnation has been so complete that the whole mass of the rock looks like solid cinnabar.

Most of the ore at the present time is coming from the eleventh level (about 850 feet). Development has been carried to the thirteenth level at a depth of approximately 1,100 feet.

Drilling is done entirely by hand. As timber is scarce, underground supports are masonry, the older workings being supported by brick arches and part of the shaft being lined with brick. In the process of modernization electric hoists have been installed but the cables used in some of the shafts are still the multiple flat hempen rope of the old type.

In the retorting of the ore the mixture of old and new methods is even more noticeable. The cinnabar is trammed from the mine to a sorting floor, piled in heaps, and the high grade is sorted out. This is carried in small baskets to chutes, dumped down into ox-drawn carts and taken to the old furnaces that were installed in the middle ages. The ore is piled into the furnaces on supports made of pieces of already retorted rock, so that there is a large proportion of open space. The furnaces are fired without passing the fumes through this mass until the whole furnace is thoroughly heated. Connections are then opened and the heated air drawn through the ore. The mercury is votatilized and passing off at the top of the furnace is carried down through inclined pottery tubes, made of sections of about 1½ feet in length, each of which has the form of a bottomless jar with a neck diameter of 4 inches and a body diameter of about 8 inches. These are fastened together with clay. The metal collects in the bulging body of the jar. When the retorting is finished the jars are separated and the mercury runs down into a trough at the bottom of the incline and thence to the bottling room. The retorted rock has the same volume that the ore had before treatment and the labour of discharging the furnaces is practically the same as that of charging. The modern plant treats the lower grade ore in huge retorts from which the vapours are carried in goose-neck down-comers and condensed continuously.

One of the difficulties of mining and treating the ore is the danger of mercury poisoning. The cinnabar breaks down naturally into mercury so that even underground there is a considerable proportion of native metal in the ore. In retorting it is almost impossible to escape the evil effects of the fumes. As a result men work only part of each month and even at that are forced in a comparatively short time to give up work at Almaden and go to the copper mines of Rio Tinto, or to take up other occupations. Costs are therefore high and labour turnover excessive even in spite of the establishment of dental clinics and other preventive measures.

From even a hurried examination of the Almaden mines it is clear that the deposits are so high in grade that no other known deposits can compete with them in the matter of production. Modernization will probably reduce the costs, but owing to the peculiar conditions of the demand for the metal and to the rare occurrence of mercury deposits the market price will be so controlled that there will be no corresponding fall in selling prices. Market prices will be fixed by the costs of operation of lower grade deposits, such as those of Italy and California, and the Spanish government will reap the benefit of the large margin of profit possible in working the high grade ores of Almaden.

The Gas Scrubbing Plant in Turner Valley

S. G. Coultis, M.E.I.C., Superintendent, Royalite Oil Company. Calgary Branch, November 15th, 1926.

During his address Mr. Coultis stated that the gas, saturated with gasoline, is throttled at the well to a pressure which balances the rate of gas cleaning in the scrubbing plant and of use by the consumers in Calgary, Lethbridge and other cities. On the way to the scrubbing plant it passes through several separators in series which remove the moisture (gasoline) content.

In the scrubbing plant the gas is passed into the bottom of a series of absorbers and out at the top, passing on the way through a spray of sodium carbonate solution which enters at the top and is atomized by falling over a series of wood grids.

He pointed out that a special problem of this plant was to find a reagent for removing the sulphur. The reagent should be cheap and such that it may be used continuously because of the small local market available for the use of any by-products that might be produced.

Referring to the absorber, he stated that hydrogen sulphide is removed from the gas by being passed through a solution of sodium carbonate in water, the resulting sodium bicarbonate and sodium sulphide in solution being then taken to the top of an actifier down which it flows through a current of air, the main reaction in the actifier being the reversal of the process in the absorber, the hydrogen sulphide liberated being allowed to escape by a chimney and the sodium carbonate is reclaimed. But there are secondary reactions in which a certain amount of sodium thiosulphate (hypo) and free sulphur are produced, and the special problem here is that if hypo is formed in excess fixed salts are formed and loss of the soda solution ensues. The following absorber reactions were mentioned:—

Absorber Reaction—

$$H_2S + Na_2CO_3 = NaHS + NaHCO_3$$
$$CO_2 + H_2O + Na_2CO_3 = NaHCO_3$$

Actifier Reaction—

$$NaHCO_3 + NaHS = Na_2\,CO_3 + H_2S$$
$$2NaHCO_3 = Na_2\,CO_3 + H_2O + CO_2$$

The sodium carbonate solution is continuously circulated and if care is taken in maintaining the proper constant temperature little of the solution is lost.

Another special feature mentioned as peculiar to this plant is the high pressure at which the process must be worked on account of the high pressures at the well casing head and in the delivery pipe lines. The pressure in the absorbers varies between 100 and 300 pounds per square inch, depending on the "pull" on the line, and at these high pressures the temperatures must be maintained constant within very narrow limits for continuous successful operation. The actifier pressure varies from 4 to 6 inches water pressure. The pressure on the plant depends on several factors: the pressure at the casing head, the temperature, and the "pull" of the consumers on the line. It is kept constant by putting more or less absorbers in series according as the demand increases or diminishes, increasing the velocity of the gas flow as the number in series is increased.

The speaker described how the gas may be received at the absorber at temperatures considerably below zero, and that it has been found that maximum absorption is obtained at just above the freezing point of water, also that the gas is steam heated, but if its temperature is allowed to rise to a temperature much over 150° F. the sodium carbonate breaks down and is lost. The diameter of the absorbers is small because of the high pressure and velocity of the gas, being 36 inches by 60 feet high.

The actifier is in the open air and also has to be heated in winter to prevent freezing, and here also, care is necessary to prevent too high a temperature. He explained that it is necessary to circulate about 60,000,000 cubic feet of air in twenty-four hours during normal weather, but that this may be doubled in hard weather when the demand for domestic gas is heavy.

He further described the mechanical part of the plant as consisting of eight 80-h.p. gas engines which were originally direct coupled to compressors for boosting low pressure gas into the delivery mains; four of these now driving triplex pumps which circulate about 15,000 gallons per hour of sodium carbonate solution and two driving fans and auxiliaries, leaving two as spares for cleaning and emergencies.

There are eight absorbers, in two banks of four in series, under normal weather conditions four or six handling the load, whereas in hard weather a whole series of eight is necessary.

Another problem, he stated, which must be faced is the possibility of rapid corrosion of the parts coming in contact with the hydrogen sulphide in solution and of erosion by suspended matter in the gas, the chimney being made extra heavy on this account. Careful record is being made of the useful life of valves and seats which are of iron, while some experimenting is being done with the newer Monel metal and stainless steel.

Continuing, he explained that the plant requires 200 b.h.p. in cold weather to supply steam for heating the buildings, heating the gas from the well and the air to the actifier, and for heating some traps, valves, etc., that are liable to become frozen because of the physical changes consequent on the process and the severe climate.

EMPLOYMENT BUREAU

Situations Vacant

Pulp and Paper Mill Engineer

Pulp and paper mill engineer wanted, about March 1st, with several years' experience in pulp and paper mill layout and operation. Should be thoroughly familiar with design of pulp and paper making machinery and be able to re-design and re-model existing machinery where necessary. Should be able to take charge of draughting end of the engineering department. Applications should draughting end of the engineering department. Applicants should state salary acceptable, experience, technical training and date available. All applications will be treated strictly confidential in the first instance. Apply, box No. 160-V, Engineering Journal.

Mining Engineer

A mining company in eastern Quebec wishes to obtain the services of a young mining engineer capable of handling underground survey work, and also some knowledge of mechanical engineering which would serve in the laying out of plant equipment. Apply, box No. 161-V, Engineering Journal.

Mechanical Draughtsmen

Two mechanical draughtsmen required by an industrial organization in Montreal. Preferably young men with shop experience. Apply box No. 162-V, Engineering Journal.

Electrical Engineer

Recent graduate required by a large electrical manufacturing concern for sales engineering and statistical work. Please state in first instance, education, full qualifications, references, salary required, age and when available. Apply box 163-V, Engineering Journal.

Situations Wanted

Mechanical Engineer

Graduate mechanical engineer of McGill University desires new connection in Quebec or Ontario. Five years' experience in draughting, plant layouts, factory maintenance, tools, materials, and methods, standardization, estimating, etc. Twenty-seven years of age. Married. Apply box 218-W, Engineering Journal.

Civil Engineer

Available at thirty days' notice after April first. Member of Association of Professional Engineers of Nova Scotia, and licensed Nova Scotia Land Surveyor. Twenty years' experience in eastern, central and western Canada and the United States, including railway location and construction, water power development surveys, construction of dams, factory and office buildings, general steel plant construction, coal mine development, including construction of bankheads, yard tracks, underground surveys, and mechanical installations. Apply box No. 219-W, Engineering Journal.

Prizes Offered for Best Papers on Greatest Improvement in Arc Welding

In the December 22nd, 1926, issue of the American Society of Mechanical Engineers' News appears an announcement that the society has accepted the custody of $17,500, to be awarded by the society in a world competition for the papers descriptive of the greatest improvement in the art of arc welding during 1927.

This fund is provided by the Lincoln Electric Company and will be bestowed in three prizes: the first award is $10,000; the second $5,000, and the third $2,500. The prizes are to be administered by the Council of the American Society of Mechanical Engineers, who will invite qualified experts to assist. Complete information can be obtained by applying to the secretary of the society, and while a more extended statement of conditions of award of the prizes is being prepared, the following is published for the guidance of prospective contestants:—

(1) The award to be made for the year 1927 as soon after January 1, 1928, as practicable.

(2) Any one in any country of the world may try for these prizes, but papers must be submitted in the English language.

(3) The papers in competition are to be supplied in duplicate to the council of the A.S.M.E., addressed to its secretary, Calvin W. Rice, 29 West 39th street, New York, before January 1, 1928. Any delay thereafter will exclude a paper from the competition.

(4) To assist authors in the preparation of papers for this competition, the following conditions are added:—

(a) The paper should include drawings of the design and careful description of apparatus needed to carry out ideas of the writer.

(b) The utility of the suggestions must be shown not only for the application, but also for possible use in connection with other designs and for their purposes.

(c) The economic saving to the industry—and therefore to mankind—by the use of the methods suggested should be pointed out.

(d) A demonstration of the practicability of the process and design is necessary. It is not necessary, however, that the actual application of this suggestion be fully shown, if a clear statement is made of possible uses.

(e) Originality of design is preferable either in the method of applying the weld or in the design of the welding parts for their arrangement. Designs which are of no practical use will only be considered in case they include suggestions which could self-evidently be applied in other ways than those suggested.

(f) Methods of applying the arc or the welding art which will improve existing machines or make commercially possible machines which in the light of previous engineering have been regarded as impractical, are specially desired.

(g) It is not necessary that all parts of the structure should be made of welded metal. It is only necessary that one or more parts be so made.

(h) Although it is stated that the limit of time will be January 1, 1928, it will be well to submit papers in competition as soon as they are prepared, that is, as early as possible in the year. In case two or more identical suggestions are received, the one arriving in the hands of the secretary of the American Society of Mechanical Engineers first will have precedence over those following.

(i) It is recommended that the small amount of literature available be studied to get the fundamental principles which govern re-design. Numerous articles have appeared in the trade journals which will be valuable, and certain companies have done much work that will be helpful in getting out a paper.

(5) The council of the American Society of Mechanical Engineers may withhold any or all awards.

(6) To facilitate filing and transmitting, it will be necessary that the paper be typewritten on one side of paper 8½ x 11 inches, bound at the top with covers that will protect it. The name and address of the sender should appear on the front cover, and if possible a brief statement of his qualifications should be included with the letter of transmittal.

The Canadian S.K.F. Company, Limited, Toronto, has issued the first volume of a publication entitled "The Ball Bearing Journal." This publication contains considerable information regarding the subject of bearings and describes the nature of rolling resistance, the carrying capacity of ball and roller bearings and various uses of the products of the company.

BRANCH NEWS

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

The Gas Scrubbing Plant in Turner Valley

An interesting and instructive address by S. G. Coultis, M.E.I.C., superintendent of the gasoline absorption and gas scrubbing plant of the Royalite Oil Company in the Turner Valley, was delivered to a large gathering of members and visitors at the general meeting held on November 15th, 1926. An abstract of this paper appears on another page of this issue.

The speaker, who assisted in designing and installing the plant, and has since been in charge of its operation, thought it was still too early to give any reliable cost data until more is known regarding the life of the various parts of the plant under the peculiar pressure and climatic conditions which it has to deal with.

An animated discussion ensued in which Dr. Atack of Kingston, Ont., and S. J. Davies, A.M.E.I.C., petroleum technologist of Calgary, took an active part.

The Head Hunters of Formosa

This was the formidable title of an address delivered before the branch by J. W. Davidson, F.R.G.S., on December 6th, 1926. This being the postponed opening meeting of the winter season was open to ladies, and a very pleasant evening was spent. Mr. Davidson proved a most interesting speaker and his address was listened to by all present with much pleasure. Many beautiful slides were presented and also several of a somewhat gruesome nature as was inevitable from the subject of the paper. It may be mentioned here that the speaker was a member of the party accompanying Peary on one of his North Polar expeditions, which goes to show that he is a much travelled man. Refreshments were served, at which Mrs. J. H. Ross, the wife of the chairman, and Mrs. G. P. F. Boese, wife of the past secretary, acted as hostesses.

Annual Dinner

The following verse appeared on the invitation card to the annual dinner, which took place on January 6th, in the Tapestry room of the Hudson's Bay Company:—

A little meet where we can greet a brother we hold dear;
A little seat where we can eat and sip the cup of cheer;
A little song to help along in case we get too sad;
A little smoke, a little joke, to make the heart strings glad;
A little plan to chase away that miserable gloom;
Don't that sound grand? Then be on hand at the Eliz'bethan room.

The chairman, J. H. Ross, A.M.E.I.C., acted also as toastmaster. Toasts were proposed and responded to as follows: "The Institute," S. J. Davies, A.M.E.I.C., and R. S. Trowsdale, A.M.E.I.C.; "Our Guests," F. K. Beach, A.M.E.I.C., and Lt.-Col. D. W. B. Spry, O.B.E., president of the Alberta Military Institute. G. N. Houston, M.E.I.C., speaking as a guest, conveyed the greetings of the Lethbridge Branch to the members present. Major D. G. L. Cunnington, M.C., also spoke in reply to the toast to the guests.

An excellent programme followed the dinner, which was conceded to surpass anything put on so far by the branch. Members of the branch taking part were G. H. Patrick, A.M.E.I.C., R. H. Goodchild, A.M.E.I.C., and W. St. J. Miller, A.M.E.I.C. Other artists on the programme rendered some splendid selections, which were enjoyed to the limit. A hearty vote of thanks was tendered by P. J. Jennings, M.E.I.C., to all those who had helped to make this evening such a success, both as entertainers, speakers and committee of arrangements, which arrangements were mainly in the hands of Secretary H. R. Carscallen, A.M.E.I.C., and Affiliate J. Cawthorne.

Halifax Branch

K. L. Dawson, A.M.E.I.C., Secretary-Treasurer.

A regular monthly meeting of the Halifax Branch was held as a supper-meeting in the Green Lantern on January 6th. C. A. Fowler, M.E.I.C., the newly elected chairman, presided, and over forty members and guests were present.

Among the guests present was I. P. MacNab, M.E.I.C., a former member and vice-chairman of the branch. Mr. MacNab, who always took an active interest in Institute affairs, was warmly welcomed by his many friends and in a brief address gave an interesting account of the people, customs and general conditions in Venezuela, where he is now stationed as general manager of the Venezuela Power Company.

The principal speaker of the evening was Captain the Hon. J. F. Cahan, A.M.E.I.C., who delivered an address on the life of Sir Sandford Fleming.

Capt. Cahan prefaced the main subject matter of his address with a discourse on the general characteristics, interests and tendencies of engineers as professional men.

The essentials of an engineering education and training tend toward a more or less specialized mathematical course, to the extent that the engineer is in danger of losing sight of the broader fields, for which, from the very nature of this education and training, he is especially well equipped. "The mathematics in which an engineer has to attain efficiency, in the course of his study, equip him to solve problems far removed from the subject in which he is trained. If science has a fault, it aims at being too definite; if mathematics have a fault, it is that the solution of a mathematical problem depends upon a definite answer." So the engineer, having solved his problem or completed his investigation, is too apt to consider his accomplishment in the light of finality and to ignore the many phases, in the broader field, which lie beyond or round about the scope of his immediate interest.

Thus it is that the engineer has not evinced the interest nor taken the prominent part in the solution of the great general public problems for which his education, training and experience have especially fitted him. His intimate relations and close contact with men in all walks of life have given him a better understanding of humanity and its problems than is enjoyed perhaps by any other class or profession, yet, "There is no question that medical men of equal personality and brain power, that lawyers no better equipped and no more aggressive, that clergymen of the same stamp, and journalists and business men, class for class, ability for ability, aggression for aggression, occupy far more outstanding positions in the country, acquire more credit and more material remuneration than does the engineer."

For such a state of affairs we, as an engineering profession, must shoulder a large share of the blame or responsibility, and with us rests the power to provide the remedy. We must not permit our immediate, technical, professional problems to narrow our vision. We must not confine our attention and activity to the special phase of a question, in which, because of our professional duty, we are directly interested. In our engineering meetings we should deal with questions of a broad public interest and guard against our papers and discussions becoming too detailed and restricted. We should take a more active part in the affairs of the country at large. In problems of development, and on economic questions of public interest, the engineering profession should have very definite ideas which would be of great value to the public bodies having to deal with such questions.

The Life of Sir Sandford Fleming

The speaker proceeded to give a sketch of the life and work of Sir Sandford Fleming, citing him as not only the foremost Canadian engineer of his time, but as occupying a position of equal prominence to that held by any professional contemporary on the North American continent.

Mr. Fleming, while engaged in the greatest engineering works of his time, necessitating arduous personal effort, found time to engage in many and varied pursuits outside the specific engineering projects directly in his charge. "He made contributions to the public welfare of this Dominion which entitle him to be forever classed as one of our first citizens," said Mr. Cahan. "He is perhaps the most outstanding engineer in our engineering records. A glance at his bibliography shows that he wrote one hundred and forty-two documents on a great variety of subjects. He wrote of railway inventions, railway termini and pleasure grounds, harbour improvements, oil wells, time, submarine telegraph, parliamentary government, postage stamps, colour blindness, post office reform, imperial intelligence service, a system of empire cables, Nova Scotia and the Empire, and the world girdling cable. Some of his contributions to The Royal Society dealing with the establishment of transcontinental railways have a breadth of view and an international scope which makes them historical documents bearing the stamp of a great mind."

Sir Sandford Fleming was born in Kirkcaldy, Fifeshire, Scotland, on January 7th, 1827, and by a strange coincidence the meeting at which Capt. Cahan's address was delivered was held within a few hours of the one hundredth anniversary of his birth. After attending the local parish school, he was apprenticed in his early teens to John Sang, an engineer and surveyor. He came to Canada in 1845. Among his early works in Canada was the compiling and publishing of a map of the town of Peterborough. He obtained the stones and lithographed the map with his own hands. At later dates he made maps of Newcastle and Toronto. In 1849 he was one of a small number of men who established the Canadian Institute and for fifty years he took an important part in its proceedings.

From 1853 to 1863, Fleming was on the staff of the Ontario, Simcoe and Huron Railroad, first as assistant engineer and afterwards as chief engineer. Subsequently he made surveys of Toronto harbour and lake Huron. In 1863 he was made chief engineer of the Intercolonial Railway, which position he held until the completion of the road in 1876. From 1871 to 1880 he was chief engineer of the Canadian Pacific Railway. It will be noted that he held these two important positions concurrently, nevertheless he found time to take an active part in public questions, notable among which was the establishment of Confederation. While some of the methods employed by Mr. Fleming were criticized by the Railway Commission and others, and there is no doubt that in the performance of his almost herculean tasks, he, being human, made mistakes, "No shadow of doubt as to his integrity ever existed."

Mr. Fleming was an ardent advocate of a state-owned cable, and "The ideas which for a time he held alone have been subsequently adopted by the whole British Empire."

"He was an engineer who did not confine himself to the mechanics of his profession, but permitted his mind to view the whole world as might one of the greater British statesmen. He was a man of prodigious energy and dominant perseverance and possessed almost a limitless capacity for arduous work. He was interested in everything from the design in lithographing and printing of a postage stamp, which he did at one time, to the construction of a national railway from the Atlantic to the Pacific. He was interested in popular representation in politics and at the same time interested in an 'All Red Cable Route,' which would embrace other British possessions. He was a great man of whom we may all be proud."

Capt. Cahan's address was supplemented by a number of lantern slides, illustrating many interesting features in connection with Mr. Fleming's life and works.

At the conclusion of this address, four reels of motion pictures were shown of the water power developments and kindred industries of the Shawinigan Water and Power Company. For these films, together with beautifully illustrated descriptive booklets, the branch is indebted to Fraser S. Keith, M.E.I.C., former general secretary of The Institute.

The thanks of the meeting was tendered to Capt. Cahan for his interesting and instructive address and to Mr. Keith for the booklets and the use of the films.

During the evening an amusing and enjoyable solo was rendered by Mr. H. F. Glass, city auditor, as well as several choruses by the members.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, Jr.E.I.C., Branch News Editor.

A meeting of the Hamilton Branch of The Institute was held in the Westinghouse auditorium on Friday, January 7th, 1927. L. W. Gill, M.E.I.C., chairman of the branch, presided. There were two hundred present. After the minutes of the previous meeting were read and approved, Mr. Gill introduced Mr. A. M. Candy of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, who gave an address on the "Arc Welding of Structural Steel Buildings," illustrated with lantern slides.

Arc Welding of Structural Steel Buildings

In introducing his subject, Mr. Candy stated that welding compared most favourably with riveting. He did not pretend that riveting did not give satisfactory results, since very good work has been done by riveting, but he considered that welding gives better results.

The company's welding engineers had long been of the opinion that arc welding could be applied to structural steel construction with advantage, and when a new building was to be erected at Sharon, Pa., they persuaded the management to use the welded construction in the fabrication of this building instead of rivets.

The factory at Sharon is 70 feet wide by 220 feet long and five storeys (80 feet) in height. Not a single rivet was used in the building. All connections were made by arc welding, erection bolts being used to hold the members in position until the welding could be done. A total of 900 tons of steel were used, which amounts to a saving of 12 to 15 per cent over the estimated amount of steel required for a riveted structure. The total cost, however, was as great or greater than the cost of a riveted building owing to the novelty of the work and the greater inspection required. Erection of steel was commenced October 27th, and completed December 3rd.

One of the desirable features of the welded construction is that it is more rigid than riveted work, thereby requiring less wind bracing. Corrosion is also relieved to a certain extent. In certain localities the elimination of noise is very important, such as in the case of hospitals. In one case which Mr. Candy cited, the proprietor of a hotel near a large structural steel building which was being erected by the riveted process stated that he would lose approximately two and one-half million dollars of business due to the noise of the riveters.

Mr. Candy showed several lantern slides of structural steel shapes made of the all welded construction which had been tested at the Carnegie Institute of Technology in Pittsburgh. A complete description of these tests is given in the Engineering Journal for December, 1926. The welded construction shows up very favourably in comparison with the riveted construction.

A hearty vote of thanks was tendered Mr. Candy, on the motion of R. K. Palmer, M.E.I.C., chief engineer, Hamilton Bridge Works, seconded by A. M. Jackson, A.M.E.I.C., county engineer, Brantford.

The next meeting was announced for January 26th, when Lieut.-Col. H. J. Lamb, D.S.O., M.E.I.C., will speak on the "Harbours of the Great Lakes."

In closing the meeting Mr. Gill expressed appreciation of the generosity of the Westinghouse Company in allowing the use of their auditorium.

Executive Meeting, January 18th

A meeting of the executive of the Hamilton Branch was held in the office of the city engineer, W. F. McFaul, M.E.I.C., on January 18th, five members being present. The details for the meeting on January 26th were finally determined and several routine matters were disposed of.

The report of the committee appointed to consider the awarding of prizes for papers was presented. Several recommendations regarding The Institute paper prizes and the awarding of Institute Students' prizes were adopted.

Hamilton Branch Prizes

It was also decided to offer a prize for papers presented by members of the Hamilton Branch, prizes for Students of The Institute who are members of the Hamilton Branch and a prize for students in the Hamilton Technical Institute. Since it is so late in the year, no prizes will be awarded for the year ending May 31st, 1927. The first award of prizes in 1928 will include papers presented from the present time until May 31st, 1928.

Conditions Governing Award of Branch Prizes

The conditions governing the awarding of branch prizes are as follows:—

A prize consisting of a certificate and $25.00 will be offered for the best paper presented by a member of the Hamilton Branch, Engineering Institute of Canada, at a branch meeting. The prize will be awarded annually if three or more papers are presented in any year ending May 31st. If less than three papers are presented such papers will be carried over into the competition of the following year. The rules governing the award of the Gzowski Medal, wherever applicable, shall govern the award of Hamilton Branch prizes. The papers entered for competition shall be judged by a committee of five corporate members of The Institute, to be called the Hamilton Branch Prize Committee.

Students' Prizes

Prizes will be offered to members of the Hamilton Branch who are eligible for Institute Students' prizes as follows:—

First prize—Certificate and $25.00.
Second prize—Certificate and $15.00.
Third prize—Certificate and $5.00.

Providing sufficient papers are presented in any year ending May 31st, all three prizes will be awarded annually. If less than five papers are presented in the competition year, the number of prizes awarded will be as follows:—

One paper only—One prize, provided it comes up to a standard of 5 per cent better than the minimum standard mentioned below.
Two papers—One prize.
Three or four papers—Two prizes.

Papers are to be delivered to the branch secretary, in duplicate, prior to the meeting at which the paper is to be presented.

One copy of the papers will be forwarded by the secretary to The Institute headquarters for The Institute Students' prize competition.

Papers ineligible for Institute Students' prizes are also ineligible for Hamilton Branch Students' prizes.

Each competitor will deliver an oral summary of his paper before a regular meeting of the branch, and will be allowed fifteen minutes for the oral presentation.

Points will be awarded as follows:—

Subject matter of paper	30 points
Arrangement and literary style	40 points
Oral presentation	20 points
Time of oral presentation	10 points

The examiners shall be the Hamilton Branch Prize Committee. In the case of the oral presentation, the actual points shall be awarded by the committee, but the order of merit shall be determined by a vote of the members present.

Regardless of the number of papers presented, no paper will be awarded a prize unless it comes up to the following minimum standard:—

For first prize—85 per cent.
For second prize—80 per cent.
For third prize—70 per cent.

If the first prize is not awarded, two second prizes may be awarded, and if first or second prizes are not awarded, two or three third prizes may be awarded.

Technical Institute Prize

An annual prize not exceeding $25.00 in value will be offered for competition by the Hamilton Branch to students of the Hamilton Technical Institute, (day or night), for the best essay between one thousand and three thousand words on any engineering subject, the award to be made by the Hamilton Branch Prize Committee and the prize to be of such nature as the branch executive considers advisable.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

Recent Developments in Boiler Furnaces

The first meeting of the year took place on January 6th, when a paper was read on the above subject by B. N. Broido, consulting engineer of the Superheater Company of New York.

The author commenced by referring to the development of boiler furnaces with the old hand-fired grates through various stages to the modern automatic stokers and the introduction of the use of powdered fuel. This development necessitated a considerable increase in the size of boiler furnaces and radical changes in their design, resulting in an exorbitant cost for construction and maintenance, as no refractories would long withstand the high temperatures.

In order to prevent the erosion of furnace walls, various means of cooling the furnaces have been developed, in some cases by the use of air-cooled blocks or hollow air-cooled walls and with boilers of high ratings by means of water-cooled furnace walls which has eliminated most of the brick work.

The question of radiation in boiler furnaces was fully discussed and how the water-cooled furnace walls affect the capacity and operation of the present large sized boilers, designed for high ratings. By use of tables and curves it was shown what furnace temperatures could be effected in a furnace with water-cooled walls burning pulverized fuels, and how this was influenced by the rate of heat liberation per cubic foot of furnace volume and also by the amount of water-cooled surface in the furnace. The benefit from pre-heated air on furnace temperatures was also demonstrated.

Some of the most modern boiler installations with water-cooled walls and equipped with superheaters were described by the speaker. He referred to the great heat losses from boiler and furnace walls which had only become generally recognized in recent years, and attempts made to minimize this loss by the use of various insulating materials, which was simplified to a great extent by the development of the water-cooled furnace. The latest designs of air-cooled brick walls were also referred to by Mr. Broido, as their use may be advantageous in some cases.

Reference was made to the new steam generator, which was described as practically a boiler built around a furnace. One of these generators has been in operation for about a year at Manchester, England, and several are now being installed in the United States.

In discussing the question of furnace control the author referred to the two serious sources of waste as incomplete combustion and hot flue gases. An illustration was shown of a recorder which records automatically both CO_2 and CO at the same time.

Following Mr. Broido, C. W. Burrows, A.M.E.I.C., gave a brief description of his new steam generator. He explained that the reasons prompting the new design were the desire to use Dominion coal and a desire to design a water wall and tube in one. After considerable study of different plants in the United States, the generator was designed and a glass model made to study the circulation of the water in the boiler.

He then described the construction of the generator and illustrated it with slides. The generator consists of sixty-four vertical tubes, arranged in a circle, the tubes being bent in at the top and bottom into headers. The water coming from the preheater enters the bottom of the tubes, passes upward through them and out at the top. The pulverized coal is the fuel which enters at the top of the cylinder and passes out through the bottom to the preheater.

Mr. Burrows stated that after six months' operation the boiler had proved entirely satisfactory, no clinkers being formed or scaling of the tubes taking place.

To illustrate the efficiency, he mentioned that when operating at 240 per cent rating, 48,000 pounds of steam per hour was generated, while when the rating was dropped to 120 per cent, 25,000 pounds per hour were generated.

Following Mr. Burrows, S. J. Fisher, M.E.I.C., referred to an installation that was made fifteen years ago in Nova Scotia of three water-tube boilers operating at 300 per cent rating, and stated that the efficiency of this boiler plant was very remarkable for its time, and in fact was practically equivalent to present day efficiency.

F. A. Combe, M.E.I.C., and R. E. MacAfee, A.M.E.I.C., also took part in the discussion, which was later answered by Mr. Broido. Mr. Durley extended the thanks of the branch to Mr. Broido and also to Mr. Burrows for his interesting contribution. F. S. B. Heward, A.M.E.I.C., was in the chair.

Modern Mercury Arc Power Rectifiers

On Thursday evening, January 13th, a paper was read by Mr. Othmar K. Marti, research engineer of the American Brown Boveri, on "Mercury Arc Rectifiers."

After explaining the necessity, from an economical standpoint, of transmitting electrical power from a long distance by means of high voltage, a.c., lines and converting it as near as possible to the site of application into direct current, where it was required to be used for such purposes as railways, the author described the various types of converters used for this purpose.

The most recent device used for converting alternating into direct current is an outgrowth of the glass bulb rectifier, which latter was not suitable for large power outputs. Many difficulties had to be overcome before the metal enclosed mercury arc rectifier was developed, and installations on a commercial scale began in Europe in 1912. From that time development went on steadily, though somewhat delayed by the war, and several large installations have been completed in Europe for railways and rolling mills, while the rectifier, with the highest d.c. voltage in the world of 4,000 v. at 1,000 k.w. has been installed in Italy.

The two factors which are responsible for the ready acceptance of the rectifier are high efficiency at all loads and the minimum attendance required.

Mr. Marti then went on to explain the elementary theory of alternating current rectification, leading up to the reason why this rectifier was a very high efficiency at high voltages. The simple and quick process of starting was given as another outstanding advantage.

Comparison was made by the author between mercury arc rectifiers and rotary converters, although he stated it was difficult to put both types of apparatus on a strictly comparative basis in regard to load, space required and price. He also described the special advantages of rectifiers for railway service and finally stated that he was convinced that in the not far distant future the rectifier, with its entrance adaptability to higher voltages, will revolutionize the electrification programmes long discussed in every country.

The paper was fully illustrated by lantern slides, and considerable discussion followed, to which it is hoped that Mr. Marti will later send a written reply. The chairman of the meeting was Professor C. V. Christie, M.E.I.C.

Kingston Branch

Gordon J. Smith, A.M.E.I.C., Secretary-Treasurer.

Annual Meeting

The annual meeting of the Kingston Branch was held in Carruthers hall, Queen's University, on December 10th, with the chairman of the branch, R. J. McClelland, A.M.E.I.C., presiding.

The customary reports were presented by the secretary-treasurer and the chairman of the Programme Committee. The branch was shown to be in a satisfactory financial position and, though the meetings held during the year had been fewer than usual, the average attendance had been considerably larger and the interest shown had been most encouraging.

The officers for the ensuing year were elected as follows:—

Chairman	Prof. L. T. Rutledge, M.E.I.C.
Vice-Chairman	Prof. D. S. Ellis, A.M.E.I.C.
Secretary-Treasurer	G. J. Smith, A.M.E.I.C.
Executive Committee	J. M. Campbell, M.E.I.C.
	Dr. L. F. Goodwin, M.E.I.C.
	Prof. A. Jackson, A.M.E.I.C.
Ex-officio	R. J. McClelland, A.M.E.I.C.
	Prof. L. M. Arkley, M.E.I.C.

After a short address by R. J. McClelland, A.M.E.I.C., the retiring chairman, in which he expressed his thanks to the members of the branch for their co-operation and help during his term of office and his appreciation of the honour of having been chairman of one of the branches of the E.I.C., the new officers were installed and the chairman-elect, Prof. L. T. Rutledge, M.E.I.C., took the chair. Prof. Rutledge in a few words stated that, though the activities of the branch had been very late in commencing this year due to the Queen's endowment campaign in Kingston, he expected that it would be possible to arrange a series of meetings for the second half of the season that would prove of more than customary interest.

At the close of the business meeting the members present had the pleasure of hearing an address by Dr. E. L. Bruce of the Mineralogy Department of Queen's on the "Mercury Mines of Spain." Dr. Bruce was in attendance at the International Geological Congress held in Spain during the past summer and while there made a close study of the mining of cinnabar, the ore of mercury. A number of slides were shown illustrating the methods of mining the ore and the distilling of the liquid metal as well as the general nature of the country surrounding the mines.

The lecture proved most enjoyable and instructive, and the appreciation of the members present was most ably presented in a vote of thanks moved and seconded by J. M. Campbell, M.E.I.C., and D. Wright. An abstract of Dr. Bruce's address appears on another page of this issue.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

At a largely attended luncheon held in the main dining room of the Chateau Laurier on December 29th, Ottawa members of The Institute had the pleasure of welcoming to Canada Frederick Palmer, president of the Institution of Civil Engineers of Great Britain. Mr. Palmer has been retained by the Dominion government to investigate and report on the ports of Hudson bay.

Welcome was extended on behalf of the Ottawa Branch by J. D. Craig, M.E.I.C., chairman, and on behalf of the council and The Institute by the general secretary, R. J. Durley, M.E.I.C., who is also a member of the British Institution. At the head table the government was represented by Hon. C. A. Dunning, minister of railways; Hon. W. R. Motherwell, minister of agriculture, and Hon. Robert Forke, minister of immigration.

Mr. Palmer's Address

Mr. Palmer said that after nearly fifty years of work he found himself in the proudest position to which any British engineer could possibly attain,—that of being president of the Institution of Civil Engineers. His real life work began in India forty-three years ago as a railroad engineer and after eighteen years of railroad building he had switched into harbour work. During recent years as consulting engineer for the government of India he has been associated with harbour, railroad and irrigation projects in that country.

The nightmare of famine in India, which previously caused millions of deaths, has been completely dispelled through the work of British engineers who brought to India the science of irrigation, Mr. Palmer said. He described two of the great irrigation works of that country,—the triple canal system of the Punjab, where the waters of the river Jhelum are led along the foothills of the Himalayas, crossing under and over huge mountain torrents to be dumped into the Chenab river and again picked up by the Chenab canals to be carried to the Ravi river where the canal crosses the river on a level crossing. There is a weir here 1,650 feet long with gates which pass the flood waters of the Ravi, (150,000 cubic feet per second). The canal restarts at the opposite bank and irrigates the former barren wilderness called the Lower Bari Doab. The immensity of the project is indicated by the distance from the Jhelum to the Lower Bari Doab, which is 500 miles, and by the capacity of the canals, which carry 10,000 cubic feet per second from the Jhelum. The system includes 433 miles of main canals, over 3,000 miles of distributaries and nearly 20,000 miles of water courses, commanding four million acres, of which two million acres are irrigated annually. Some one and a half million acres were absolutely barren wilderness. The country also had to be colonized and transportation provided. In one desert area, where there had been a population of 8,000, there were 800,000 people in ten years.

The second great work outlined was that of the river Periyar, where waters rising in impenetrable malaria stricken jungle and destined by nature to flow to the Arabian sea are now carried across the peninsula and led into the bay of Bengal. An irrigation work now in progress in Sind eclipses in magnitude any previous work. The canals will carry 50,000 cubic feet per second, (25 per cent more than the Ottawa river), from the river Indus and will command an area of seven and a half million acres.

The need for irrigation in India was stressed by Mr. Palmer with figures on rainfall. It varied from nil in Sind to a maximum of 900 inches at a place in Assam. In Sind there were thousands of square miles in which the rainfall was so insignificant that nothing grew thereon. From barren deserts devoid even of animal and bird life these huge territories have been transformed into veritable gardens by irrigation.

British rule has also brought to India a transportation system of 41,000 miles of railway and well equipped ports, notably Bombay and Calcutta. In these two ports alone, the shipping entering approaches fifteen million tons per year, while the value of the seaborne trade is in the neighbourhood of two thousand million dollars per year. Transportation is comparatively cheap in India at one cent per ton mile on goods and one-half cent for coal, while passengers are carried for two-thirds cent per mile.

Mr. Palmer did not discuss in any way his mission to Hudson bay, except to remark that a few weeks ago he was looking over harbour works on the equatorial gold coast and now was assigned to the Arctic region. He urged that closer relations should exist among the engineering associations of the world and particularly those of the British Empire.

Celestial Engineering

At the first luncheon of the new year, held at the Chateau Luarier on January 13th, a well-known member of the Ottawa Branch, R. Meldrum Stewart, M.E.I.C., director of the Dominion Observatory, was the speaker. Mr. Stewart chose as the subject of his address "Celestial Engineering."

The measurement of distances to the stars was in its inception that of the problem of the engineer or surveyor in measuring distances to an inaccessible object, Mr. Stewart explained. It was a matter of measuring the base of a triangle and the opposite angle, or the parallax, then solving the triangle. For instance, to get the distance to the moon it was a simple matter to observe its zenith distance at say Greenwich and Cape Town, but as distances increased the parallax angle became much smaller and sufficient accuracy could not be obtained with this simple method. The parallax of the sun is only about nine seconds, so observations were taken on an astroid called Eros, which gave a better object to observe on, and from the relationship existing between the periods of revolution of the earth and Eros around the sun and then distances therefrom it was easy to calculate the distance to the sun.

The nearest star is at a distance of four light years, Mr. Stewart said, and the parallax angle, using the distance from earth to sun as a base, was less than one second. Distances to over 1,000 stars had been determined by this method, but it became inaccurate for distances of over 100 light years, and only our nearest neighbours were within this radius. The average distance of all stars we can see with the naked eye is 300 to 400 light years. Mr. Stewart then sketched the methods used in obtaining the distances to stars further away, using relative motion, periods of revolution of binary stars and the relation between apparent and actual brightness. Actual brightness is determined from photographs of the spectrum of stars. This relationship was the means of determining the distances of 3,000 stars.

Still Mr. Stewart carried his audience off into space, past the milky way, which is the earth's galaxy of stars arranged in a circular band with a diameter of 300,000 light years, and on to other galaxies. The great Andromeda, he said, is the only one of the spiral nebulæ visible to the naked eye, and appears in very clear weather as a star cloud. Means had been found to measure its distance from the earth, and it had been determined that the great Andromeda nebula was 1,000,000 light years away. This galactic system had a diameter of 50,000 light years. It is our nearest neighbour among the nebulæ, of which there are thousands further away, some of which form galactic systems greater than our "Milky Way." Mr. Stewart dwelt in terms which, he said, admittedly "meant nothing,"—the distances are beyond the comprehension of man and, "It is laughable, to say the least of it," he concluded, "that mere man, under these circumstances, should sometimes imagine that he is of some importance."

J. D. Craig, M.E.I.C., chairman of the Ottawa Branch, presided at the luncheon, which was very well attended, about one hundred members listening to Mr. Stewart's address with the greatest interest.

Annual Meeting

Noulan Cauchon, A.M.E.I.C., town-planning expert and consulting engineer, was honoured with the chairmanship of the Ottawa Branch for the ensuing year, at the annual meeting which took place on the evening of January 13th, at the Daffodil, succeeding J. D. Craig, M.E.I.C. F. C. C. Lynch, A.M.E.I.C., was re-elected secretary-treasurer. New members elected to the Managing Committee for a period of two years were: Walter Blue, A.M.E.I.C., Alan K. Hay, A.M.E.I.C., and F. H. Peters, M.E.I.C. Members of the 1926 committee who continue in office for another year are: Col. A. E. Dubuc, M.E.I.C., and W. A. Rush, A.M.E.I.C.

The new chairman is prominent in town-planning, and for eighteen years has endeavoured to bring about a federal district planned along scientific lines. He is at present chairman of the Town-Planning Commission of Ottawa, and is an honorary member of the Ontario Association of Architects. Mr. Cauchon was with the Canadian Pacific Railway for twenty years, and filled the post of assistant engineer to the Board of Railway Commissioners for two years.

The report of the retiring chairman, J. D. Craig, M.E.I.C., indicated that the year had been one of varied activity. Mr. Craig particularly stressed the necessity of the engineer taking a greater interest in community affairs, and expressed his keen appreciation of the co-operation of the Management Committee and the members of the various sub-committees.

The chairman regretted having to record the loss through death of seven valued members: Dr. Martin Murphy, M.E.I.C., F. A. Wise, M.E.I.C., Le Roy T. Bowes, A.M.E.I.C., Col. Georges Roy, M.E.I.C., A. A. Dion, M.E.I.C., Thomas Shanks, BRANCH AFFILIATE, and E. C. Hutchinson, A.M.E.I.C.

Other reports were presented by the secretary-treasurer; W. A. Rush, A.M.E.I.C., chairman, proceedings committee; Col. A. E. Dubuc, M.E.I.C., chairman, membership committee; M. F. Cochrane, M.E.I.C., branch librarian, and Alan K. Hay, A.M.E.I.C., sub-committee on advertising. The reports of committees indicated that the Ottawa Branch had experienced an active and very satisfactory year. Mr. Lynch's report indicated that the branch finances are in very satisfactory condition.

Through the courtesy of B. E. Norrish, A.M.E.I.C., Associated Screen News of Canada, a film of "Felix the Cat" was screened, to the amusement of the engineers. The Canadian National Parks also contributed an interesting movie of wild life in New Brunswick, in addition supplying an operator. Community singing was also held, Mr. Charles O'Reilly officiating at the piano.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

The annual meeting was held in the Y.W.C.A. rooms on December 17th, 1926, following a dinner at which Mr. J. W. Curran, editor of the Sault Daily Star, was a guest.

Chairman C. H. Speer, M.E.I.C., called the meeting to order and the various standing committees reported on their share of the year's activities. The Paper Committee, under C. Stenbol, M.E.I.C., is to be commended upon the year's programme. The secretary-treasurer's report showed the branch in good standing and the average attendance at the meetings for the year was 27, which is fifty per cent of the resident members. The Nominating Committee reported the result of the election for 1927 as follows:—

Chairman	Geo. H. Kohl, A.M.E.I.C.
Vice-Chairman	R. S. McCormick, M.E.I.C.
Secretary-Treasurer	A. H. Russell, A.M.E.I.C.
Executive	R. A. Campbell, A.M.E.I.C.
	W. S. Wilson, A.M.E.I.C.
	J. G. Dickinson, M.E.I.C.
	C. R. Murdock, A.M.E.I.C.
Ex-officio	C. H. E. Rounthwaite, A.M.E.I.C.
	C. H. Speer, M.E.I.C.

The auditors appointed for the year were C. H. E. Rounthwaite, A.M.E.I.C., and W. S. Wilson, A.M.E.I.C.

The retiring chairman, C. H. Speer, M.E.I.C., gave a short review of the year's activities. He expressed his appreciation for the assistance and co-operation of the members and committees during the past year and he felt sure that the new executive would still improve the standing of the branch, and he would give all the assistance that he could.

Geo. H. Kohl, A.M.E.I.C., the new chairman, thanked the members for the confidence that they had expressed in him by electing him for 1927 to carry on after such an able chairman as Mr. Speer. Mr. Kohl has been working on a programme and it looks as if there will be a treat in store for the members the coming year.

Visit to Plant of Sault Daily Star

At 8.30 under the guidance of Mr. J. W. Curran, editor of the Sault Daily Star, the members visited the offices and plant of our enterprising daily and there we saw everything. The offices of the various departments, the job printing department, the linotypes, the large press, etc., and even the telegraph instrument tucked away in the corner, were all inspected.

The inspection started in the business office, where we were given an opportunity to examine the Star's cabinet of Algoma curios, including Indian relics, etc., and the cabinet of samples of Algoma minerals and other products. The exhibit of the handiwork of the

Technical School students was much admired. The editorial and reporters' rooms were next visited, which had been specially cleaned up for the occasion, (as one of the staff admitted). The mechanical department came next and the members were more at home, and the machinery and operation of same underwent a close inspection, especially from those who follow the mechanical branch of our profession. There we saw the linotypes in action setting up the day's news, and each of our members received a linotype slug with his name cast on it as a souvenir. There are six operators and they turn out fifty columns of type per day. The assembling of the galleys of type as taken from the linotypes into pages on the makeup table was most interesting. The page form was run through the matrix machine and the cardboard thus made was taken to the stereotyping room, where a cylindrical plate was cast from it. This plate was trimmed and trued and then placed in the big press, which was started up and ran off copies of a special edition of the Star, with the large headline across the top of the front page "Special Edition for Engineering Institute," which were given to the members as another souvenir of our visit. This large press turns out 25,000 copies of a 24-page paper every hour, it weighs forty tons, and the papers come out folded and counted.

The efficiency of the whole organization shows a capable manager at the head of a thoroughly well organized staff of skilled office workers and mechanics.

As a fitting finish to a most pleasant evening, Mr. and Mrs. J. W. Curran, as hosts, assisted by the girls of the staff, served coffee and cake to the visiting members in the large business office.

A hearty vote of thanks was moved by J. Hayes Jenkinson, A.M.E.I.C., to Mr. and Mrs. Curran and the staff of the Sault Daily Star for the royal manner in which they had entertained the members of our branch. Mr. Curran replied, expressing his pleasure in being able to have the members of the Sault Branch as guests and he cordially invited them all back some other time, and mildly suggested (amid cheers) that it would be after May 1st.

Vancouver Branch

F. P. V. Cowley, A.M.E.I.C., Secretary-Treasurer.

The annual meeting of the Vancouver Branch was held in the auditorium of the Vancouver Board of Trade on Wednesday, December 15th, 1926, at 8 o'clock p.m.

After the reading of the minutes of the previous annual meeting and the appointment of scrutineers to count the ballot for the election of officers, the secretary presented his annual report, the details of which are embodied in the Vancouver Branch report to Council, which is to be presented at the annual meeting of The Institute.

Following the transaction of general business, the retiring chairman, W. H. Powell, M.E.I.C., addressed the members as follows:—

The Retiring Chairman's Address

There are two periods of gratification to every person who undertakes the chairmanship or presidency of any organization: first, when assuming the office he realizes the confidence the members have placed in him; second, when leaving the office he breathes easily, as he feels that he is relieved of the duties that the position demanded.

One year ago this branch honoured me by electing me chairman, and I felt at the time and do still that the Nominating Committee played me a trick when they failed to place a second name on the ballot. It was unconstitutional. But never during the year was it necessary for your chairman to vote, accordingly your own unanimity of purpose has eliminated all doubt as to the legality and regularity of the appointment.

My year as chairman has been marked by considerable activity in the institution, and for this highly gratifying result I take absolutely no credit. The programme of visits to works and the excellent series of addresses which are now being held are the result of a great deal of work on the part of the Executive Committee, and particularly on the part of our secretary, E. A. Wheatley, A.M.E.I.C. Words cannot express my appreciation of his efforts to make this year a success. Probably no branch ever undertook a more pretentious programme, and I trust that those booked for the future will have your wholehearted support. I am sorry to say that in the past the attendance of Institute members at these meetings has not been all that your chairman desired, nor all that the study and preparation by the speaker merited. The only boast I make is that during my time as chairman I attended every trip and every meeting and I can truthfully say that each was enjoyable and profitable.

In connection with our trips, I would here like to speak a word of appreciation of the kindness of the British Columbia Electric Railway, the Britannia and the harbour board officials, who made our trips to Alouette, Britannia and around our harbour so pleasant that those who went will always have memories of unexcelled arrangements, unparalleled courtesy and unlimited hospitality.

Continually we are asked if it is worth while obtaining membership in The Engineering Institute, and I think that every engineer should be able and willing to point out the advantages of that connection.

A Dominion-wide organization working along the lines of facilitating professional knowledge, promoting professional interests, encouraging education and research and enhancing the usefulness of the engineers to the profession, must eventually bring to engineers proper recognition of their own worth to the community and then, aided by due scrutiny, examination and selection of those authorized to call themselves engineers, which can only be done at present by provincial legislation, we will finally arrive at the stage where the title, "Member of Engineering Institute of Canada," is the hall mark of superior education, highest professional ideals and the absolute confidence of the public in those essential engineering requirements.

The branch this year was fortunate in that we had as one of our most active driving forces the president of The Institute, Major Geo. A. Walkem, M.E.I.C. At the Professional Engineers' dinner forecasts were made of what we may expect from this highly talented engineer, and I'm sure that this branch will give to Major Walkem its unqualified support in the administration of any position to which he may be selected, for we know he is liberal with his assistance, conservative in his attitude, progressive in his ideas and not at all provincial in his views. His services to the branch this year as in the past should not be forgotten.

I cannot close without mentioning P. H. Buchan, A.M.E.I.C., who for many years served this branch as secretary, but pressure of work last spring forced him to ask to be relieved of those duties. We all truly appreciated his quiet attention to duty, the perfection and simplicity of his system and the accuracy of his records and accounts. He continues as one of the faithful of the Executive Committee.

Mr. Powell's address was received with continued applause, and when this had subsided the chairman called for the report of the scrutineers, which shows the following branch officers elected for the year 1927: F. W. Alexander, M.E.I.C., chairman of the branch for 1927, by acclamation; W. Brand Young, A.M.E.I.C., as vice-chairman, by election; F. P. V. Cowley, A.M.E.I.C., secretary-treasurer, by acclamation, and P. H. Buchan, A.M.E.I.C., H. W. Frith, M.E.I.C., A. C. R. Yuill, A.M.E.I.C., members of the Executive Committee, by election. These, together with those elected for the two-year period, in 1926, namely, W. B. Greig, A.M.E.I.C., E. A. Wheatley, A.M.E.I.C., J. R. Grant, M.E.I.C., together with ex-officio members, namely, Major Geo. A. Walkem, M.E.I.C., W. H. Powell, M.E.I.C., constituted the Executive Committee of the branch for the year 1927.

Mr. Powell then handed over the chair to his successor, Mr. Alexander, who, in a short address, expressed his appreciation of the honour accorded to him, stating his admiration for the high standing set by his predecessor and his determination to live up to that standard.

Mr. Young then thanked the members for electing him vice-chairman of the branch, and in conclusion asked the members to accept, through him, the regrets of Mr. Cowley, the newly elected secretary-treasurer, who was unable to be present on account of ill health.

After transacting other necessary items of business, a general discussion was held as to ways and means of improving the attendance at meetings and in this connection W. H. Powell, M.E.I.C., paid a tribute to Major H. B. Muckleston, M.E.I.C., whose attendance was one hundred per cent. He submitted to the elected executive that they act as an attendance committee, and by personal effort see that individually they bring some two or three to attend each meeting.

Victoria Branch

K. M. Chadwick, M.E.I.C., Secretary-Treasurer.

A very interesting paper on the manufacture of wood pulp was presented before the Victoria Branch by W. L. Ketchen, M.E.I.C., of the British Columbia Pulp and Paper Company, Limited, on December 15th, 1926.

Mr. Ketchen introduced his subject with an outline of the early history of the manufacture of sulphite pulp, and before entering into the details of its present manufacture, he pointed out the importance of the wood pulp industry in Canada. In 1925, 227,465 tons of bleached sulphite, and 615,320 tons of unbleached sulphite were manufactured in this country. The wood consumed in the production of this was approximately 1,686,000 cords.

Mr. Ketchen quoted from the United States Department of Agriculture Bulletin, which in 1924 stated: "A recent study of the world's timber supply shows that coniferous species supply nearly one-half of the timber cut in the entire world. They occupy little more than one-third of the world's area of forest lands. Furthermore, the current growth of coniferous is less than four-fifths of the cut. The critical timber supply problem of the next half century at least will centre in the coniferous forests. The speaker then referred to the forest conditions in some of the European countries. He then explained that it required in capital between $30,000 and $40,000 per ton to build a bleached sulphite mill, exclusive of the cost of an hydro-electric plant and timber limits, the cost depending to a large extent on the location of the mill.

Mr. Ketchen then went into considerable detail in describing the manufacturing processes, explaining the various stages of manufacture under three principal headings: the preparation of the wood; the preparation of the acid and the cooking process; and the preparation and bleaching of the pulp after cooking.

Towards the close of his address the speaker devoted some time to describing various articles into which sulphite pulp can be manufactured, dealing particularly with the several methods of making artificial silk. The lecture was illustrated by many instructive lantern slides and at the end of Mr. Ketchen's address a hearty vote of thanks was extended to him.

Maximum Spans for Dwelling House Floor Joists with a Plastered Ceiling on Underside

The following span table is based on actual sizes of joists, according to United States standards for lumber and on the working stresses approved by the Division of Building and Housing of the United States Department of Commerce.

SPECIES OF LUMBER	Joist Spacing Center To Center	These spans are limited by the stiffness of the piece and calculated so the maximum deflection when supporting the full live and dead load shall not exceed 1/360 of the span length. Live load assumed as 40 pounds per square foot of floor area. Dead load includes a lath and plaster ceiling estimated to weigh 10 pounds per square foot and double flooring at 5 pounds per square foot plus the weight of the joist itself. These span lengths apply to all grades in each species indicated. Utilizing the full bending strength of the joists and disregarding deflection would allow greater spans but the plaster ceiling would then be likely to crack. Calculations based on the actual sizes of joists according to American Standards for Lumber.									
		MAXIMUM SPANS FOR JOISTS (FOR ALL GRADES)									
		2 x 6	2 x 8	2 x 10	2 x 12	2 x 14	3 x 6	3 x 8	3 x 10	3 x 12	3 x 14
	Inches	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.	ft. ins.
Cedar, Northern & Southern White Spruce, Engelmann	12	7 11	10 11	13 4	16 2	18 7	9 2	12 2	15 4	18 4	21 4
	16	7 2	9 10	12 3	14 9	17 0	8 5	11 2	14 1	16 11	19 8
	24	6 4	8 8	10 11	12 9	15 0	7 5	9 10	12 5	14 11	17 5
Balsam Fir Western Red Cedar Idaho & Northern White Pine, California, Sugar & Pondosa Pine, Lodgepole Pine	12	8 6	11 5	14 4	17 3	20 0	9 11	13 1	16 5	19 9	23 1
	16	7 9	10 5	13 1	15 9	18 4	9 1	12 0	15 1	18 2	21 3
	24	6 10	9 2	11 6	13 10	16 3	7 11	10 8	13 4	16 1	18 9
Alaska Cedar Fir, Noble, Golden, Silver & White Hemlock, Eastern	12	8 10	11 9	14 9	17 9	20 8	10 3	13 7	17 0	20 5	23 10
	16	8 0	10 9	13 6	16 3	18 11	9 4	12 5	15 7	18 9	21 11
	24	7 1	9 5	11 10	14 4	16 8	8 3	10 11	13 9	16 7	19 5
Port Orford Cedar Douglas Fir, Rocky Mtn. Type, Norway Pine; Redwood, Spruce, Red, White and Sitka	12	9 1	12 0	15 2	18 3	21 2	10 6	13 11	17 6	20 11	24 5
	16	8 3	11 0	13 10	16 9	19 6	9 8	12 9	16 1	19 4	22 6
	24	7 3	9 8	12 2	14 9	17 3	8 5	11 3	14 2	17 1	20 0
Larch, Western Tamarack, Eastern	12	9 4	12 4	15 7	18 9	21 10	10 10	14 4	18 0	21 8	25 1
	16	8 6	11 4	14 3	17 2	20 0	9 11	13 2	16 6	19 10	23 2
	24	7 5	9 11	12 6	15 2	17 8	8 8	11 6	14 7	17 7	20 6
Cypress, Southern Hemlock, West Coast	12	9 6	12 8	16 0	19 3	22 6	11 2	14 8	18 5	22 1	25 9
	16	8 8	11 7	14 7	17 7	20 6	10 2	13 5	16 11	20 4	23 9
	24	7 7	10 2	12 10	15 6	18 1	8 11	11 10	14 11	18 0	21 0
Douglas Fir, Coast Type Southern Yellow Pine	12	10 0	13 3	16 8	20 1	23 5	11 8	15 4	19 3	23 1	26 11
	16	9 1	12 1	15 3	18 5	21 5	10 8	14 0	17 8	21 3	24 10
	24	8 0	10 8	13 5	16 2	18 11	9 4	12 4	15 7	18 9	22 0

*Prepared by Richard G. Kimbell, architectural engineer, National Lumber Manufacturers Association.

Preliminary Notice

of Applications for Admission and for Transfer

January 18th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in February 1927.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ASHBY—REGINALD BEALE, of Montreal, Que., Born at York, England, Nov. 8th, 1902; Educ., B.Sc., McGill Univ., 1924; 1921 (summer), shop work, Dom. Engrg Co.; spring 1923, demonstrator, McGill survey school; 1924-25, student engrg. course with Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.; 1925-26, supervising splicing and loading of Quebec toll entrance cable and testing for transmission, engrg. staff, Bell Tel. Co., Eastn. div.; at present, engrg staff, Foundation Co. of Can. Ltd.

References: P. S. Gregory, C. V. Christie, G. M. Hudson, J. J. Macdonald, W. Griesbach.

BIRKETT—LEONARD HARRIS, of Montreal, Que., Born at Kingston, Ont., Nov. 22nd, 1890; 2 yrs. faculty of Applied Science, Queen's Univ., 1911-13; summers of 1908-09-11-12-13, shop work, Can. Locomotive Works, Kingston; 1910 (summer), rod and chainman, mtce. of way survey C.P.R. Kingston; June 1914 to May 1915, special apptce. course C.P.R., shop work, road work and test dept.; 1915-19, C.E.F. infantry and Can. Engrs. as commissioned officer; 1919-21, mech. dept. C.P.R. Montreal, locomotive design and detail, also dynamometer test car; 1921 to present, sales engr. for Superheater Co. Ltd., Montreal, i/c industrial sales and engrg.

References: A. Macphail, J. A. Shaw, F. S. B. Heward, C. W. Burroughs, R. M. Calvin, A. L. Morgan.

CARNWATH—JAMES, of Woodstock, Ont., Born at Riverside, N.B., Jan. 22nd, 1890; Educ., B.Sc., McGill Univ., 1911; 1907 (summer), rodman, M. of W. Dept., I.C.R.; 1908 (summer). sub-foreman, Can. Copper Co.; 1909 (summer), office and layout work, Morrow & Beatty Ltd.; 1910 (summer), engr., Morrow & Beatty, survey work for W. S. & R. S. Lea, and foreman for Quinlan & Robertson on Mtl. aqueduct; 1911-14. contractor engr. and asst. supt. for Morrow & Beatty on constrn. of hydro-electric power plants, storage dams and pulp and paper mills; 1914-15, asst. supt., Bathurst Lumber Co. Ltd., on constrn. of pulp and paper mills; designing equipment for Forest Products Labs., Mtl., in 1915-16; 1916-18, engrg. sales and promotion, overseeing constrn. concrete roads and pavements for Canada Cement Co.; 1918, six mos. special tech. examiner, Federal Trade Comm'n., on price fixing investigations; 1919, sales engr., R. Martens & Co. Ltd.; 1920 to date, manager, Independent Concrete Pipe Co. Ltd.

References: J. A. Beatty, W. S. Lea, H. Holgate, A. A. McDiarmid, G. G. Robinson, J. A. Vance, W. G. Ure, W. G. Mitchell.

LOTIMER—JAMES STANLEY, of Niagara Falls, Ont., Born at Hamilton, Ont., Oct. 12th, 1885; Educ., public school Toronto and correspondence Chicago; 1900-05, apptce. course, United Electric Co., Toronto; 1905-07, constrn. and operating foreman, South. Light & Power Co., constrn. sub-foreman, Can. Gen. Elect. Co.; 1907-09, West. representative, Nernst Lamp Dept., Can. Westinghouse Co., Winnipeg; 1909 to present, H.E.P.C. as: 1909-11, building and equipment inspector, Toronto; 1911-20, supt. of elect'l mtce., Niagara System, Hamilton; 1920-23, system supt., Thunder Bay System, Port Arthur; 1923 to date, supt. of elect'l mtce., Niagara district, Niagara Falls.

References: F. A. Gaby, T. H. Hogg, H. G. Acres, G. Hogarth, A. B. Cooper, H. V. Hart, M. V. Sauer.

MACDONALD—HUGH, of St. John, N.B., Born at sea, June 30th, 1889; Educ., St. John primary and high school, Setford and Bryce Engrg. Academy, Liverpool, England; 4 yrs. apptce., St. John Iron Works; 1910-11, 4th engr., S.S. Gloria de Larrinaga; 1911-13, 3rd engr., S.S. Ventura de Larrinaga; 1913-14, 2nd and 1st refrigerator engr., S.S. Minico; 1914-16, Dredge Don. Frederico, St. John, 2nd and ch. engr.; 1917-18, 3rd engr., Grand Trunk steamer Prince Rupert; 1918-20, 2nd engr., S.S. Prince George; 2nd engr., S.S. Prince Rupert, acted as chief for two months; 1916-17, i/c Monton Griffith dredging plant; 1921 to date, i/c power plant, Atlantic Sugar Refineries, St. John.

References: H. F. Bennett, G. H. Waring, G. N. Hatfield, J. Carey.

McWILLIAM—ARCHIBALD, of Windsor, Ont., Born at Glasgow, Scotland, Mch. 26th, 1891; Educ., attended Royal Tech. College, Glasgow; 1910-14, dftsman for design and detailing of factories and also surveying with Peter Caldwell, architect, Paisley, Scotland; 1914-19, dftsman for industrial works design with Home-Morton, Ker & Gibson, civil engrs., Glasgow; 1919-20, structural designer, P. W. MacLellan Ltd., Glasgow; 1920-24, structural steel detailer and checker, Can. Bridge Co., Walkerville, Ont.; 1924-26, structural steel checker, Whitehead & Kales Ltd., Detroit, Mich.; at present, structural design and details, Giffles & Vallet, Detroit.

References: G. F. Porter, A. E. West, H. A. Spencer, A. W. Hanks, G. V. Davies.

PHILLIPS—JOHN BERNARD, of Montreal, Que., Born at Montreal, Aug. 19th, 1899; Educ., 4th year applied science, McGill Univ.; 1913-23, employed by Finley Smith & Co. Ltd., Mtl.; 1924 (summer), driller at Dome Mines, South Porcupine, Ont.; 1925, employed by Imperial Oil Co.; 1926 (summer), cement inspector, J. T. Donald & Co. Ltd., chemist, Brown Corp., La Tuque, Que.

References: C. M. McKergow, A. R. Robert, C. V. Christie, E. Brown, R. deL. French, J. R. Donald.

STIRLING—GROTE, of Kelowna, B.C., Born at Tunbridge Wells, England, July 31st, 1875; Educ., Crystal Palace School of Engrg., London, England, 1892-95; 1897-1902, asst. engr's office, Midland and G. T. Northern Joint Railways; 1898-99, asst. res. engr., North. Walsham and Mundesley Ry.; 1899, res. engr. various widenings and station reconstrn.; 1902, res. engr. bridge reconstrn.; 1902-07, res. engr., Cromer & Mundesley Ry.; 1907-11, private practice in Norfolk, England, road and municipal work; 1912-13, res. engr. constrn. of Black Mt. Water Co.'s main irrigation system, Kelowna; 1916 to present time, private practice in B.C., M.P. for Yale, B.C.

References: G. A. Walkem, F. W. Groves, J. C. McDonald, F. H. Peters, V. Meek.

WATSON—HUGH MONROE, Jr., of Westmount, Que., Born at Cornwall, Ont., Nov. 18th, 1889; Educ., B.Sc., McGill Univ., 1911; some surveying and general engrg. work during vacations while at college; 1913-16, checking shop details of structural steel for bridges and bldgs., Dom. Bridge Co. Ltd.; 1916-22, dfting and engrg. depts., i/c drawing office and responsible for design and strength of details of structural steel, also i/c designing steel work for bldgs.; 1922 to date, ch. asst. to contracting engr. of Dom. Bridge Co., engaged in estimating costs and making prices on all types of steel structures, i/c contracting dept. in absence of contracting engr.

References: H. M. MacKay, P. L. Pratley, F. P. Shearwood, LeR. Wilson, D. C. Tennant.

WICKWIRE—JAMES LEANDER, of Port Arthur, Ont., Born at Kentville, N.S., Mch. 14th, 1902; Educ., B.Sc. McGill Univ., 1924; 1922 and 1923 (summers), instrument work on highway engrg. and town surveying with N. S. Highway Board, and 1924 (summer), same work with Seth W. Crowell; 1924-25, plant layout with Bell Telephone Co. of Canada, Montreal Div.; 1926 to date, grain elevator design work with C. D. Howe & Co., Port Arthur, Ont.

References: H. M. MacKay, E. Brown, R. deL. French, S. Crowell. C. D. Howe, R. B. Chandler.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

GRANT—LeROY FRASER, of Kingston, Ont., Born at Toronto, Nov. 7th, 1884; Educ., Diploma R.M.C., 1905, B.Sc. Queen's Univ., 1926; 1904, rodman, Guelph and Goderich Ry.; 1907-08, dftsman and levelman, G.T.P. Ry., Prince Rupert, B.C.; 1908-09, res. engr., G.T.P. Ry., Prince Rupert; 1909-10, on land surveys with F. S. Clements; 1911-14, land surveys, irrigation and power projects, municipal work, etc., with Dutcher, Maxwell & Co.; 1915-16, capt. overseas with Ry. Constrn. Corps, 1917-18, major, 2nd in command, 5th Brig. Can. Ry. troops; 1919 (summer), i/c party, Southern Okanagan irrigation project; 1920, i/c of party on surveys for B. C. Govt.; 1921-22, instructor in engineering, R.M.C.; 1923 to date, associate prof. of engrg., R.M.C.

References: H. K. Dutcher, W. P. Wilgar, D. Hillman, E. C. Goldie, A. MacPhail, N. M. Hall.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

ALDOUS—HERBERT, of Hamilton, Ont., Born at Watford, England, Sept. 15th, 1893; Educ., I.C.S. diploma concrete engineering; 1915-19, overseas with Sanitary Corps; 1919-21, deputy engr. i/c large public works contract, Norwich, England, extensive factory extensions, boiler house and plant, water softening plant, roads, drains and sewers; 1921, Gov't. inspector, Ont. Dept. of Public Highways; 1922-25, estimating engineer on heavy constrn. work, reinforced concrete, factories, warehouses, foundations, sewerage disposal works; 1925-26, temporary engr. large extension to pulp and paper mill, Powell River, B.C., responsible for field work re boiler house extension; at present, designer and estimator, W. H. Cooper, gen. contractor, i/c estimating dept. and responsible for design of all classes of construction work.

References: J. A. McFarlane, A. R. Holmes, A. L. P. S. Clifford, F. T. Nichol, N. L. Crosby.

BAYNE—BLAIR EDMONSTON, of Moncton, N.B., Born at Halifax, N.S., Nov. 26th, 1893; 3 yrs. engineering Dalhousie, N.S. Tech., E.E., 1922; N. B. Electric Power Commn., roadman and instrumentman on bldg. of St. John-Moncton transmission line, looked after installing of sub-stations during latter part of time at Moncton and Sussex, work finished May 30th, 1923; on survey party as transitman to locate a spur from Hardwood Ridge to Minto, on preliminary survey work between Lockeport station and town, work finished end of Aug. 1923; Jan. 15th to May 1924, levelman on Kingsclear-Vanceboro survey, tsfrd. to hbr. engr's office, remaining there until end of year looking after dredging at Cape Tormentine and Port Borden; July 1925 to present, with C.N.R.; maintainer on storage battery car at Halifax for two months, and since that time has been on the road doing wiring jobs for the electrical supervisor; war service; 13 months in munition factory at Moncton, 1916-17; Nov. 1917, passed for Air Force and trained, receiving commission of 2nd lieut., June 1918, in August going to Netheravon Camp, England.

References: F. O. Condon, A. S. Gunn, F. B. Fripp, C. S. G. Rogers, H. J. Crudge, G. L. Dickson.

DUNBAR—JOHN ROBERT, of Hamilton, Ont., Born at Toronto, Mch. 11th, 1900; Educ., B.Sc. McGill Univ., 1920; 1 yr. post-graduate study Mass. Inst. Tech.; summers of 1918-19 and 20, Geodetic Survey of Canada; Nov. 1920 to Sept. 1921, transformer design, Can. Westinghouse Co. Ltd., Sept. 1921 to Sept. 1922 and June 1923 to Sept. 1925 with same Co., generator and motor design; Sept. 1925 to date, i/c A.C. generator and synchronous motor design, Can. Westinghouse Co.

References: H. E. Hart, W. F. McLaren, H. B. Dwight, C. V. Christie, E. G. Burr, J. C. Nash, C. F. Medbury.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

BOISMENU—ROMEO, of Montreal, Que., Born at Montreal, June 22nd, 1899; Educ., 2 yrs. Univ. of Montreal, for four years chainman, City of Montreal.

References: N. J. A. Vermette, J. E. Gill, W. T. Jamieson, W. Dickson, C. Godin, J. G. Caron, G. R. MacLeod.

KINGSTON—THOMAS MARTYN SIBBALD, of Buffalo, N.Y., Born at Penetangueshene, Ont., Oct. 11th, 1900; Educ., B.A.Sc. Univ. of Toronto, 1924; 1921 and 1922, summers, worked with res. engr. on constrn. work of Toronto Harbour Commn.; 1925, acted as office engr., E. P. Muntz Inc., Buffalo, N.Y., handled layout work and a portion of engrg. work for Seneca Iron & Steel Co. plant and coal trestle for Delaware Lackawanna and Western Co.; March 1926, in office of division engr. of Lehigh Valley Railroad; June 1926, field engr., Fed. Portland Cement Co.

References: T. R. London, C. R. Young, J. R. Cockburn, C. L. Hays, E. P. Muntz, P. Gillespie.

MILLS—CHARLES PERKINS, of Albany, Ga., Born at Ottawa, Ont., Mch. 19th, 1899; Educ., B.Sc. McGill Univ., 1923; 1920 (summer), rodman, G.T.R. survey; 1921 (summer), clerk, Central Experimental Farm, Ottawa; 1922 (summer), student engr., management div., Stone & Webster, Boston; June to Jan. 1923, student engr. with same company; 1923-24, secretary to gen. mg., Columbus Electric & Power Co., Columbus, Ga.; 1924-25, student industrial engr., Columbus Electric & Power Co.; 1925 to date, sales manager of S. Georgia Power Company, a subsidiary of Columbus Electric & Power Co., and under executive management of Stone & Webster Inc.

References: N. E. D. Sheppard, C. V. Christie, A. R. Roberts, H. M. MacKay, E. Brown.

FOR TRANSFER FROM AFFILIATE TO A HIGHER GRADE

EISENHAUER—ERLE ELI, of Claresholm, Alta., Born at Martins River, N.S., Nov. 13th, 1893; Educ., B.Sc. (Agriculture) Univ. of Sask, 1918, B.Sc. Civil and Irrig. Engrg., Colorado State Agri. Coll. and School of Mech. Arts, Fort Collins, 1922; 1918-20, i/c water investigations and stream measurement in ditches for Dom. Dept. of Int. Irrig. Branch at Coaldale, Alta.; 1923-26, i/c irrigation instruction in Alta. schools of agriculture; 1923-24, i/c special instruction in irrig., Univ. of Alta.; 1925, i/c irrig. ditch surveying in Lethbridge North. irrig. district, and supervision of another party in same district; 1926, i/c irrig. ditch surveying in Lethbridge North. irrig. district and inspection of work of several other survey parties; at present, irrig. specialist with Alta Gov't, schools of agriculture.

References: G. N. Houston, P. M. Sauder, L. C. Charlesworth, S. G. Porter, V. M. Meek.

THE

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Hydro-Electric Power Developments on the Gatineau River

The Important Features of the Farmers, Chelsea, and Paugan Power Developments of the Gatineau Power Company

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Paper presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec Que., February 15th to 17th, 1927

The Gatineau river rises in the Laurentian mountains at the height of land near the headwaters of the St. Maurice and the Bell rivers, and flows in a southerly direction through a rugged and generally well wooded country to its junction with the Ottawa river at Hull, opposite the city of Ottawa.

The drainage basin of the river has an area of 9,600 square miles, which is about one-sixth of the total area drained by the Ottawa river. In its length of 275 miles it falls about 1,200 feet, half of this fall occurring in the last 135 miles, below the mouth of the Gens-de-Terre river, one of the principal tributaries of the Gatineau. The mean annual precipitation over the watershed is approximately 34 inches, and from one-half to three-quarters of which reaches the river as run-off.

The Department of Public Works of Canada has taken gauge readings at Chelsea since 1900, and at Alcove, fifteen miles above Chelsea, since 1917. Mr. S. S. Scovil, M.E.I.C., has correlated the readings of these gauges and has worked up dependable flow records for the last fourteen years. These records show a minimum flow during this period of 1,900 c.f.s., in February 1918, and a maximum of 72,300 c.f.s. in May 1924. The maximum flow of which there is any record is about 76,000 c.f.s.

Lumbering operations have been conducted along the Gatineau and its tributaries for many years, and in order to facilitate the floating of logs, timber dams have been built on a number of the tributaries. Until recently this has constituted the only attempt at regulation and has been used solely for log driving. At present, however, a large concrete dam is being built under the direction of the Quebec Streams Commission on the Gatineau river about thirty miles above Maniwaki. The reservoir formed by this dam will have an estimated storage capacity of 90,000,000,000 cubic feet, and will afford a minimum regulated flow of 8,000 c.f.s. in the dryest years. The ultimate regulated flow of the river has been estimated to be between 10,000 and 11,000 c.f.s.

Location of the Three Developments

Very little engineering investigation has been made along the river above the mouth of the Gens-de-Terre. Below that point there are a number of sites where the development of power is practicable, three of the more important of which, at Farmers rapids, Chelsea and Paugan falls, are at present being developed by the Gatineau Power Company.

The Farmers development is located four and one-half miles above the mouth of the Gatineau. One fall is being utilized in this development giving a head of 66 feet. The dam at Farmers will back the water up to the tailrace at Chelsea, a distance of one and one-quarter miles.

Work on the Chelsea development was begun about two months before that at Farmers. By drowning out four falls above Chelsea rapids and backing the water up to the Paugan tailrace, a head of 93 feet is obtained at this point.

The third of this group of developments, Paugan, is situated twenty-six miles above Chelsea or thirty-two miles above the mouth of the river. The high dam that is being built below the falls will back the water up to Chute Calumet, a distance of thirty miles, drowning out nine falls and rapids and creating a head of 136 feet.

By combining the operation of these three developments into one system it will be possible to utilize to the best

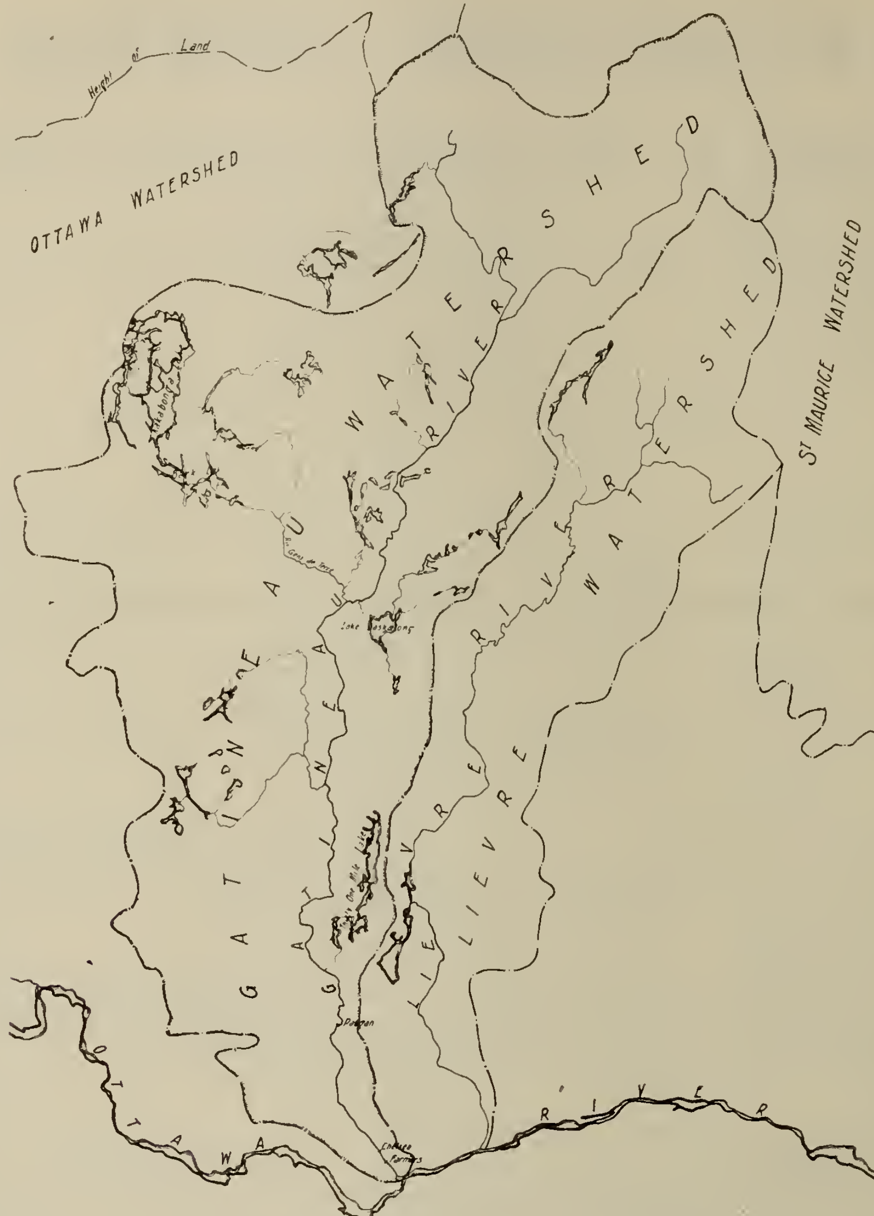


Figure No 1.—Gatineau Watershed Showing Location of Farmers, Chelsea and Paugan Power Developments.

advantage the total fall in the river from Chute Calumet to its mouth, a distance of sixty-two miles, and to develop at least two-thirds of the available power in the whole river. The storage provided by the ponds created above the Chelsea and Paugan plants will assist materially in the regulation of the system and should eliminate all possibility of trouble from ice.

Available Market for Power to Be Developed

The principal customers of the Gatineau Power Company are the Canadian International Paper Company, whose plant at Gatineau will take a large block of power, the Hydro-Electric Power Commission of Ontario, which will take power for distribution in Ontario, and the Hull Electric Company.

Owing to the fact that the Hydro-Electric Power Commission's system is operated at 25 cycles while the Canadian International Paper Company's mill and the system of the Hull Electric Company are at 60 cycles, the three developments will supply two independent distribution systems.

Although Paugan will be the principal source of 25-cycle power, one 25-cycle generator is being installed at Chelsea and one at Farmers in order to equalize the hydraulic demand of the three developments.

The Chelsea generators are being supplied by the Canadian Westinghouse Company and have a rating of 36,000 kv.a. for the 60-cycle machines, and of 32,000 kv.a. for the 25-cycle machine, all at 100 r.p.m. The Canadian General Electric Company is supplying the Farmers generators. The 60-cycle machines in this plant have a rating of 25,000 kv.a. at 90 r.p.m., while the rating of the 25-cycle machine is 22,500 kv.a. at 88.3 r.p.m. The generator in all cases is 6,600 volts.

Each generator will be connected to its respective bank of transformers, which will step the voltage up from 6,600 to 110,000 volts for transmission to Hull, to the paper mill at Gatineau and to the Paugan system.

The 60-cycle lines from Chelsea and Farmers will feed into a central switching station, which will be so arranged that excess power can be transmitted to the paper mill for use in electric boilers.

General Features of the Power Stations and Hydraulic Works

Chelsea and Farmers Developments

The Chelsea and Farmers power houses have a good many points of similarity. Both are of the type which has become practically a standard for low and moderate head developments, in which the substructure of the power house forms a part of the dam and contains the turbine intakes with their headgates and racks, as well as the turbine casings and draft-tubes. They are both laid out for five units, three of which are being installed in each power house at present.

The turbines are vertical machines, manufactured by the Dominion Engineering Works, with single Francis type runners. Those at Chelsea have a rated capacity of 34,000 h.p. each, at 93 feet head and a speed of 100 r.p.m. The rated capacity of the Farmers turbines is 24,000 h.p. at 66 feet head.

The regulation of the turbines is obtained by hydraulic governors. The water from the operating cylinders is dis-

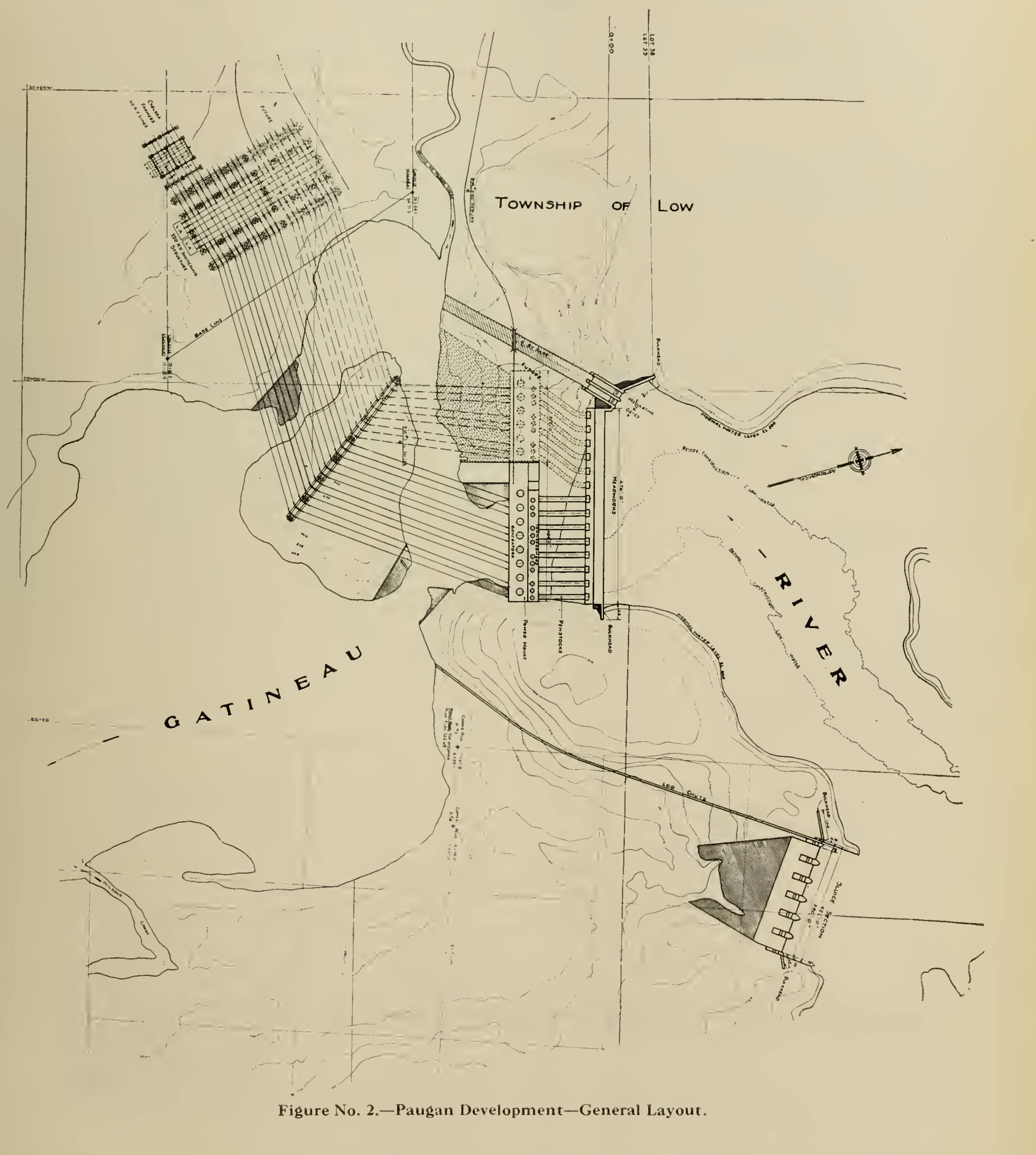


Figure No. 2.—Paugan Development—General Layout.

charged into a concrete sump tank which runs the full length of the building in the pipe tunnel on the upstream side of the generator room. From the sump tank the water is returned to the high-pressure system by three pumps, two of which are motor-driven and one turbine-driven, which are located, together with the air compressors for the governor system and the station service pumps, in the pump pit between units Nos. 2 and 3.

Each turbine intake consists of three water passages, those at Chelsea being eleven feet wide and those at Farmers twelve feet wide. The water passages are each provided with a set of steel trash racks with rack bars spaced about 3½ inches apart and a Stoney headgate. The headgates are motor-operated through a line shaft which runs the full length of the gate house and which can be connected by means of clutches to each hoist. Three sets of steel emergency gates have been provided to facilitate the unwatering of the intakes.

The power house superstructures are, of course, fireproof throughout and the various banks of transformers, oil switches, disconnecting switches and the high tension bus rooms have been so separated and isolated by means of partitions, barriers and fire doors that a serious flash-over or fire originating in one part of the power house cannot be communicated to other parts. The building walls and main partitions are of plastic brick. Auxiliary partitions and barriers are of metal lath and cement plaster. In the transformer rooms and oil-switch rooms the steel members of the structure have been encased with brick or concrete, while all floors and roofs are of reinforced concrete. Metal sash have been used throughout the buildings and all doors to switch rooms, bus rooms, control room, offices, etc., are kalameined.

The generator rooms, pump pits, corridors, lavatories and mess rooms are floored with red quarry tile with a tile cove around the walls. The walls of these rooms and of the offices are plastered. All walls and ceilings throughout the building are painted in light buff or white, kalameined doors and trim are dark brown and all exposed steel and steel sash are dark olive green.

The generator rooms are served with 150-ton travelling cranes. The crane in the gate house at Chelsea has a capacity of 30 tons and that at Farmers 50 tons. The reason for this difference is that at Farmers the railroad siding comes in at the upper level so that transformers and turbine parts are handled from the cars by the gatehouse crane and lowered through a transfer well to the transformer room level, while the siding at Chelsea enters on the generator room floor and this equipment is handled by the generator room crane.

Paugan Development

Above Paugan a mile of fast water, in which the river drops thirty feet, terminates in a small rocky pool. From this pool the river flows over Paugan falls, a sheer drop of twenty-eight feet, into a short, narrow gorge, at the foot of which it divides into two channels which empty into a large shallow basin. The walls of the gorge are very steep, on the east side rising almost perpendicularly for more than one hundred feet, and are flanked by high, rocky hills.

The main dam will be built in the gorge a short distance below the falls and will run across the hill on the west side to the higher ground beyond. This dam will contain two regulating sluices, each twenty feet wide, and the intakes for fourteen turbines. The maximum height of the dam, from the bottom of the gorge to its crest, will be 165 feet.

Some distance above the falls, a sluice dam will be built in a natural depression in the hill flanking the river. This dam will contain a log chute and six sluiceways each fifty feet wide provided with Stoney sluice gates and will discharge into the basin below the gorge. The dam has been designed for a discharge capacity of 120,000 c.f.s. at high water.

The power house will be located at the foot of the gorge; the turbines being connected to the intakes with steel penstocks seventeen feet in diameter. The substructure will contain the settings for eight units at present, each unit having a rated capacity of 34,000 h.p. at 132 feet net head and 125 r.p.m.

In order to take care of the flow of the river during

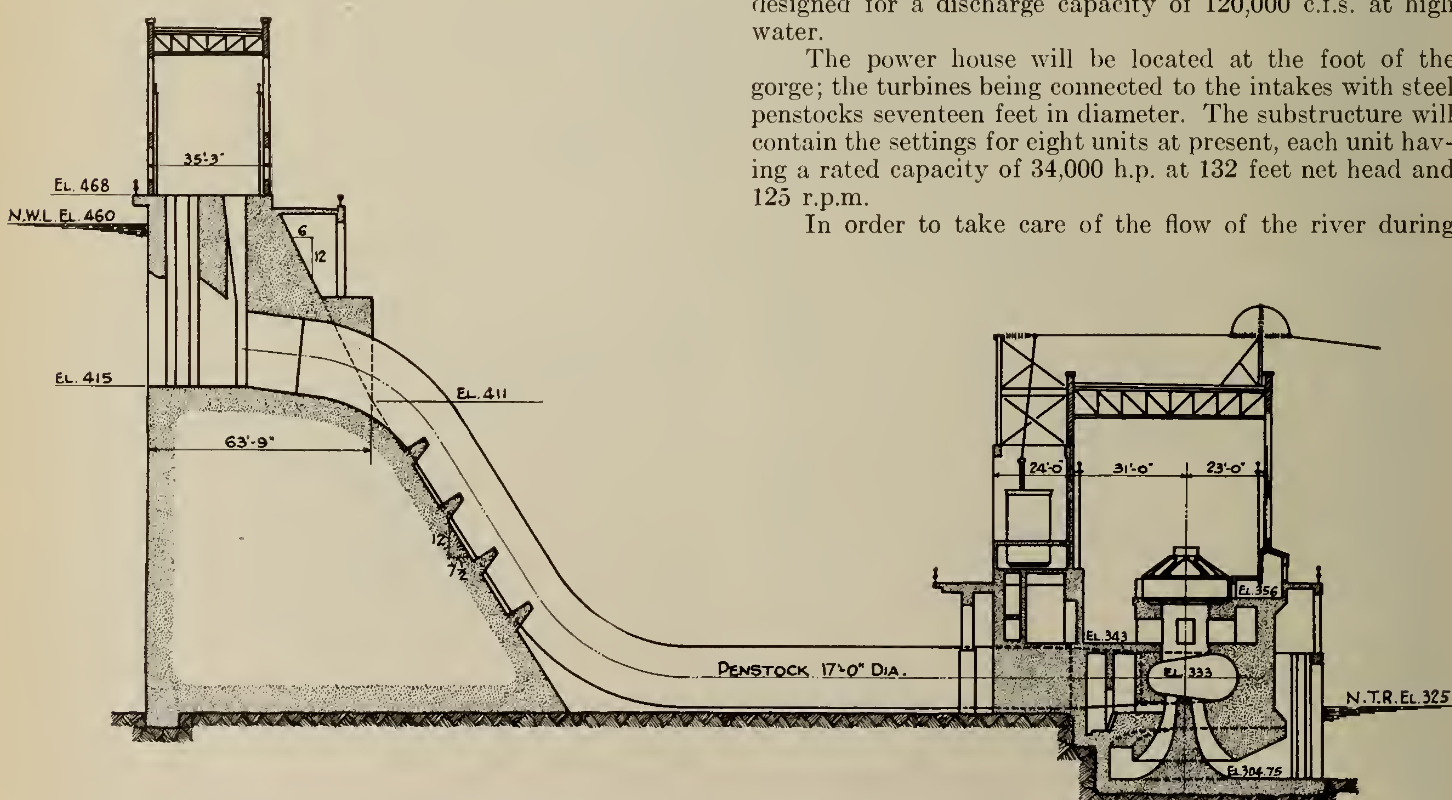


Figure No. 3.—Paugan Development—Typical Section Through Headworks and Power House.

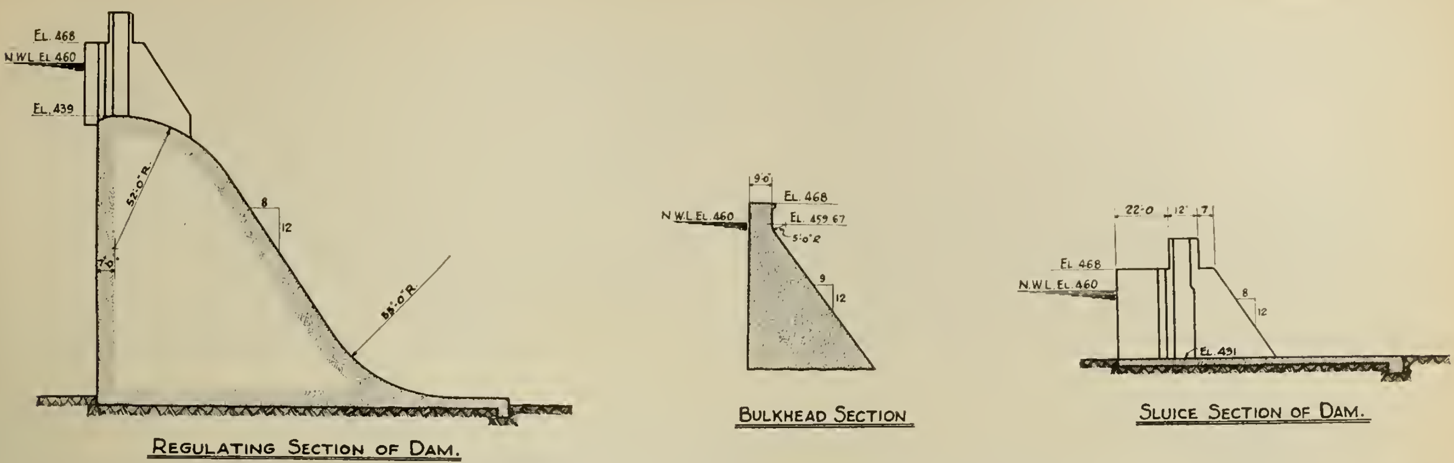


Figure No. 4.—Paugan Development—Typical Sections Through Dam.

construction of the intake dam and the power house, a deep channel which will be capable of taking care of the full flow of the river up to 30,000 c.f.s. is being excavated from the pool above the falls to the west channel below the gorge. The bottom of this by-pass channel will be about twenty feet below the present level of the pool. Upon the completion of the development this channel will take the discharge from the regulating sluices.

Details in the Design of the Chelsea Development

At Chelsea, the river is divided into two channels by a small, rocky island. The dam, which is 1,600 feet long, runs almost due east and west across this island. Beginning at the west side, the dam consists of about eighty feet of bulkhead section, the power house substructure 303 feet long, another 95 feet of bulkhead section, the west spillway section 300 feet long, the sluice section 325 feet long, the east spillway section 480 feet long, and about 50 feet of bulkhead which contains the log chute adjoining the east bank. The dam carries a reinforced concrete bridge with a twelve-foot roadway supported on concrete piers on the spillway section, which gives access to the power house from the east bank.

The discharge at Chelsea during maximum known flood was about 76,000 c.f.s. At normal high water, the dam, with five feet of freeboard, has a discharge capacity equal to one and one-half times this flood.

The sluice section of the dam contains five sluiceways each fifty feet wide. These sluiceways are provided with Stoney gates which are raised and lowered by a motor-driven travelling hoist on a steel bridge above the sluice dam.

The lowest point of the dam is in the main channel at about el. 215, sea level datum. All sections of the dam are of the gravity type and have been so designed that with the full static head against the upstream face of the dam with water at el. 320 acting together with an assumed upward pressure on the base of the dam equivalent to the full head at the heel and decreasing uniformly to zero at the toe the resultant will fall within the middle third.

The power house was located in the western channel in order to permit the railroad siding to enter at the generator room floor level. This channel was widened and deepened to form the tailrace canal which joins the main channel at the foot of the island.

The Power House

In designing a structure of this type it is necessary first of all to determine the general characteristics of the development, such as capacity and number of units, line voltage and arrangement of low-tension and high-tension busses, switching equipment and transformers, the character of the load and the relation of the development to other power plants on the same system.

After these characteristics have been determined, certain preliminary data must be obtained with regard to the dimensions and weights of generators and turbines, the amount of the hydraulic thrust and the layout of turbine casings and draft-tubes. With this information at hand a preliminary layout is made to determine the spacing and arrangement of the units. This layout is checked by means of the stability diagram.

The forces which must be taken into consideration in the design are the external forces, consisting of the hydrostatic pressure against the upstream face of the structure, the uplift that may develop due to seepage along the base and the weight of the structure itself and of the generators and turbines, together with the hydraulic thrust, and the internal forces, which consist of hydrostatic and surge pressures in the intakes, water passages and turbine casings.

In low head developments the intake and scroll-case blocks can usually be so constructed and reinforced that they will act together in resisting hydrostatic pressure and uplift. In the case of the Chelsea development this was found to be impracticable, and consequently the intake block was made sufficiently heavy to take care of these forces without assistance from the scroll-case blocks. It was also found necessary to limit the amount of uplift that might develop by building a cutoff wall at the heel of the structure and providing an 18- by 18-inch box drain 18 feet from the heel.

The units at Chelsea are spaced 48 feet centre to centre. Referring to the stability diagram, it will be noted that the hydrostatic pressure per unit is 5,400,000 pounds, with a moment arm of 60 feet, and the assumed maximum uplift is 1,620,000 pounds with a moment arm of 79 feet. The overturning moment therefore will be the sum of the moments of these two forces or 452,000,000 foot-pounds.

The water passages in the intake structure have been reinforced to take care of the internal pressure, so that the most unfavourable condition for stability is with the emergency gates closed and the water passages empty. This is the condition for which the diagram has been drawn. The weight of the structure and of the water above the emergency gates is 24,630,000 pounds, with a moment arm of 45 feet. The resisting moment therefore is 1,111,000,000 foot-pounds. This gives a factor of safety against overturning of about 2.5. The sliding coefficient of the structure, being the quotient of the pressure divided by the weight minus uplift is low, $\frac{23{,}010{,}000}{5{,}400{,}000} = 0.24$.

Intake Structure

In the detailed design the maximum unit stresses allowed were 12,000 pounds per square inch tension in the steel and 500 pounds per square inch compression and 50 pounds per square inch shear in the concrete. Reinforcing bars which are under full tension are embedded or lapped at least 60 diameters.

The various members of the intake structure are reinforced as follows:—

(1) Main Walls Between Units. These walls are seven feet thick. The main system of reinforcement is vertical and takes care of bending tension due to hydrostatic pressure with one intake empty and adjacent intake full and of direct tension due to the water pressure on the floor of the intake. A secondary system of horizontal bars is used to take the reaction from the vertical members at the emergency gate and rack slot and the headgate slot and to tie the head wall to the intake walls.

The vertical members are designed as slabs fixed at the upper end and supported at the lower. Taking as a typical

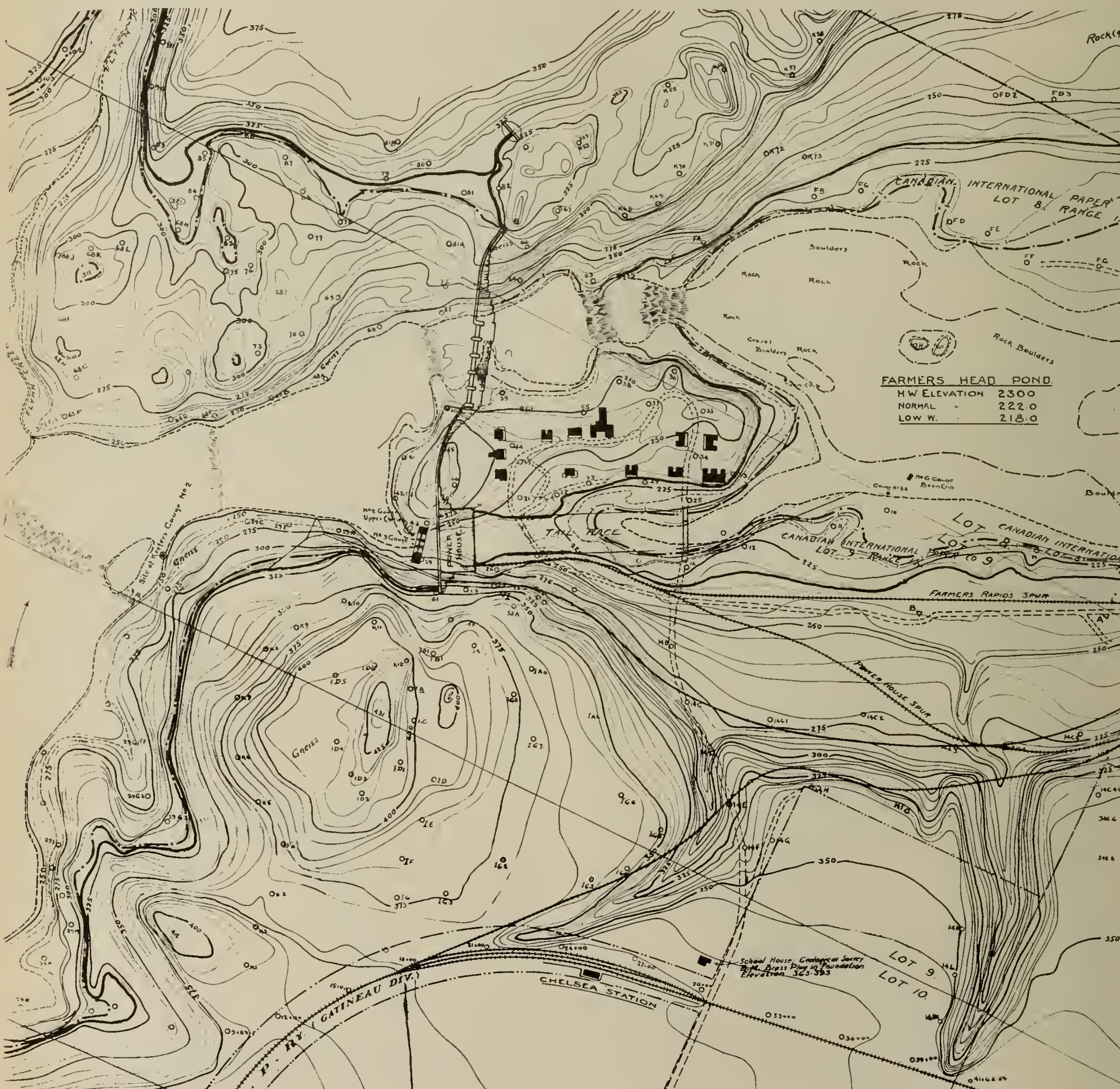


Figure No. 5.—Farmers and Chelsea

case the section of wall between emergency gates and racks the area of reinforcement required is found as follows:—

The span is 32 feet and the pressure diagram is a trapezoid with the lower base equal to 3,125 pounds per square foot.

The bending moment at any point X above the base will be

$$M = R_1x - \frac{wx^2}{2} + \frac{bx^3}{6}$$

in which R_1 = the bottom reaction,
w = the pressure per square foot at the bottom,
and b = the increment of pressure = 62.5 pounds per square foot.

The bottom reaction equals

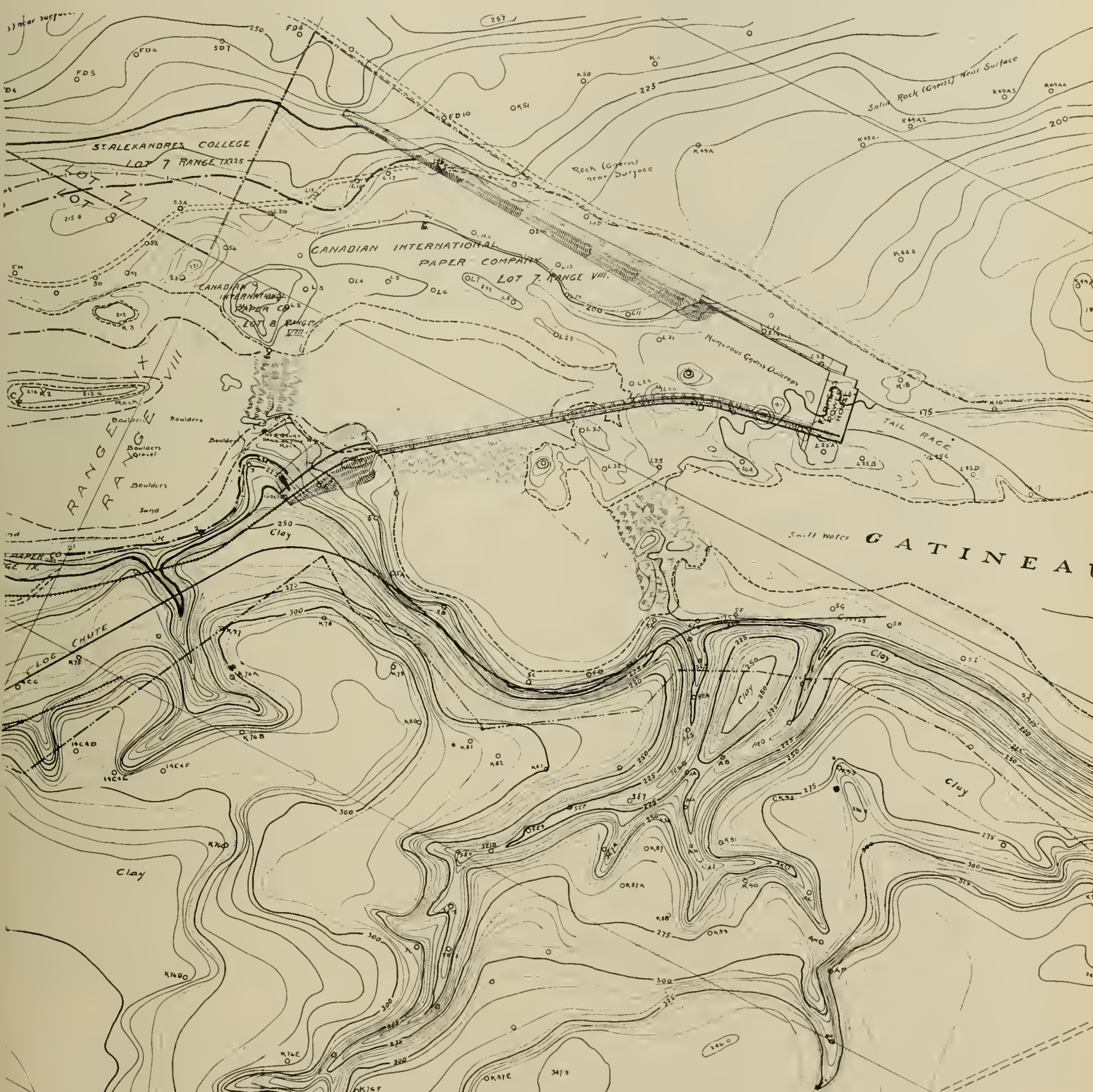
$$R_1 = \frac{3}{8} \times 3125 \times 32 - \frac{62.5 \times 32^2}{10} = 37500 - 6400 = 31100 \text{ pounds}$$

and the maximum moment equals

$$M_{max} = 31100 \times 32 - \frac{3125 \times 32^2}{2} + \frac{62.5 \times 32^3}{6} = -264000 \text{ foot-pounds}$$

$$A_s = \frac{264000 \times 12}{11000 \times 6.5 \times 12} = 3.7 \text{ square inches per foot.}$$

(2) Intermediate Walls. These walls are 4 feet thick, and have been designed for a difference in head between one side and the other of 27 feet. This difference in head may be brought about by having the emergency gates closed and the headgates open in the two outside passages of any unit and the headgate in the centre passage closed, while the machine is full open. It would be possible under this condition for 3,000 c.f.s. to flow from the central intake to the



Developments—General Layout.

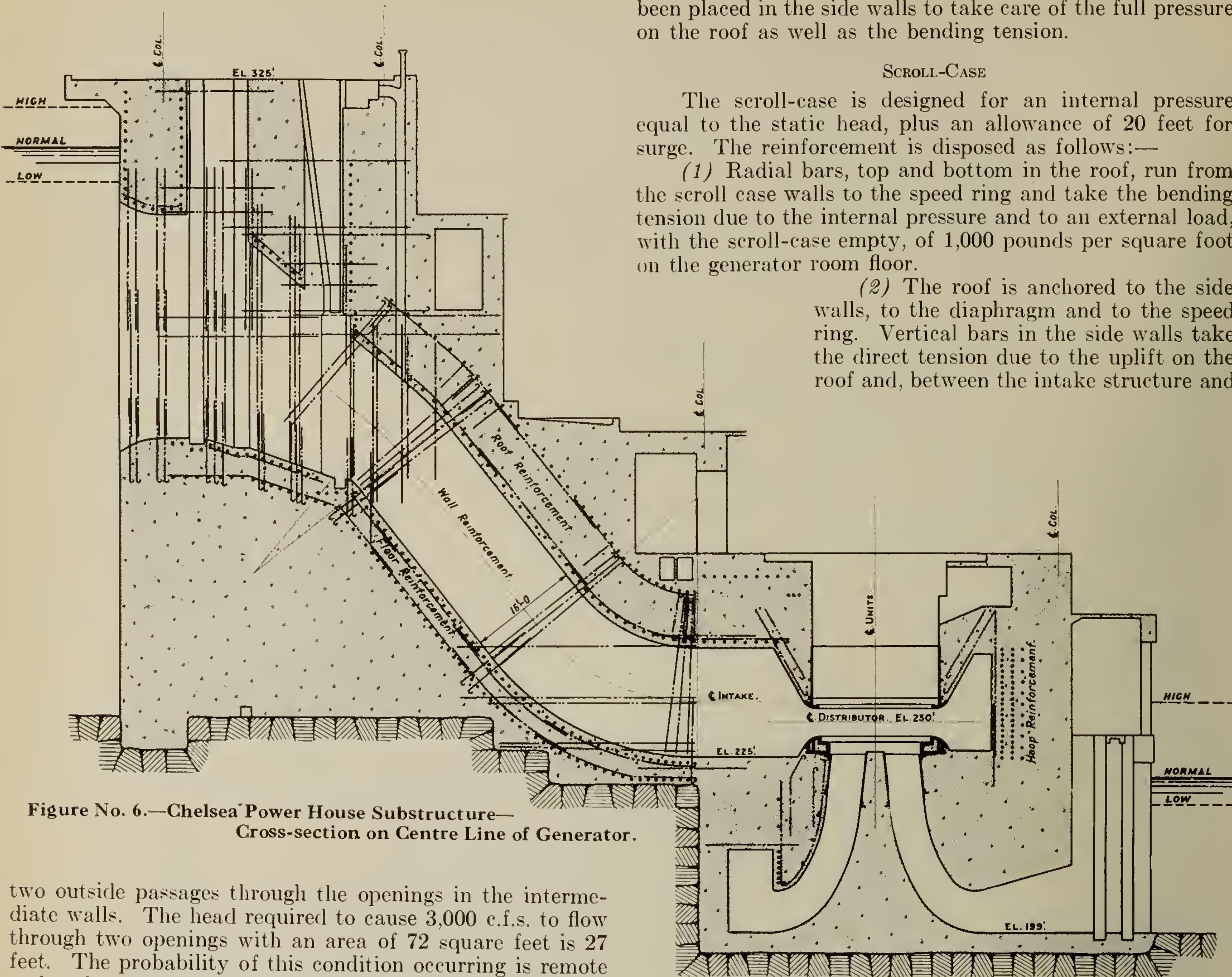


Figure No. 6.—Chelsea Power House Substructure—Cross-section on Centre Line of Generator.

two outside passages through the openings in the intermediate walls. The head required to cause 3,000 c.f.s. to flow through two openings with an area of 72 square feet is 27 feet. The probability of this condition occurring is remote and we have therefore increased the unit stresses in this wall to 18,000 pounds per square inch in the steel and 750 pounds per square inch in the concrete.

(3) Headwall. The headwall is 12 feet 4 inches thick, and has clear spans between bottoms of headgate gains of 14 feet 2 inches. The reinforcement required for bending is negligible. Three-quarter inch bars have been put in horizontally on 12-inch centres, near each face, to prevent the formation of shrinkage cracks. Sufficient reinforcement has been run from this wall into the main and intermediate intake walls to take care of the reaction from the water pressure.

(4) Floors of Intakes. The floors of the intakes are reinforced at the top between the emergency gates and the box drain to take bending due to uplift and at the bottom for the water pressure and the dead weight of the floor. Dowels from the floor project upward into the intake walls to take the reactions due to this pressure.

(5) Curtain Wall. Horizontal reinforcement has been placed in the curtain wall, which is 10 feet thick, sufficient to take an ice pressure of 50,000 pounds per lineal foot.

(6) Water Passages. Below the headgates the water passages down to the entrance to the scroll-case are designed all around for internal pressure equal to the full static head, plus an allowance of 10 feet for surge. Sufficient steel has been placed in the side walls to take care of the full pressure on the roof as well as the bending tension.

Scroll-Case

The scroll-case is designed for an internal pressure equal to the static head, plus an allowance of 20 feet for surge. The reinforcement is disposed as follows:—

(1) Radial bars, top and bottom in the roof, run from the scroll case walls to the speed ring and take the bending tension due to the internal pressure and to an external load, with the scroll-case empty, of 1,000 pounds per square foot on the generator room floor.

(2) The roof is anchored to the side walls, to the diaphragm and to the speed ring. Vertical bars in the side walls take the direct tension due to the uplift on the roof and, between the intake structure and the longitudinal centre line of the scroll-case, take the bending tension due to the internal pressure.

(3) Between the longitudinal centre line and the down stream side of the scroll-case the tension due to internal pressure on the walls is taken by three rows of hoops. Owing to the fact that the scroll-case and draft-tube block is not stable by itself, these hoops project into and anchor the scroll-case to the intake structure.

In determining the bending and direct stresses in roof and walls, the scroll-case is divided into a number of sectors and each sector calculated separately. Taking as a typical example the sector on the longitudinal centre line we have:—

(1) Roof

Scroll-case empty — Span = 8 feet 0 ins. Eff. depth = 8 ft. 0 ins.
Dead and live loads = 2100 lbs + 1000 lbs. = 3100 lbs. per sq. ft.

$$M = \frac{3100 \times 8^2}{8} = 24800 \text{ ft.-lbs.}$$

$$A_s = \frac{24800 \times 12}{10760 \times 8 \times 12} = 0.3 \text{ sq. in. per ft.}$$

Scroll-case full — Span	= 9 ft. 0 ins.
Pressure	= 6250 lbs. per sq. ft.
Weight of Roof	= 1500 lbs. per sq. ft.
Net uplift	= 4750 lbs. per sq. ft.

$$M = \frac{4750 \times 9^2}{8} = 48100 \text{ ft.-lbs.}$$

$$A_s = \frac{48100 \times 12}{10760 \times 8 \times 12} = 0.56 \text{ sq. in. per ft.}$$

(2) Side Wall

Span = 11 ft. 0 in. Eff. depth = 7 ft. 8 ins.

$$R_1 \text{ (at bottom)} = \frac{7060 \times 11}{2} - \frac{3 \times 62.5 \times 11^2}{20} = 37700 \text{ lbs.}$$

$$M_1 \text{ (at bottom)} = -\frac{2 \times 37700 \times 11}{3} + \frac{7060 \times 11^2}{4} - \frac{62.5 \times 11^3}{15}$$

$$= -68450 \text{ ft.-lbs.}$$

$$M_2 \text{ (at top)} = -68450 + 37700 \times 11 - \frac{7060 \times 11^2}{2} + \frac{62.5 \times 11^3}{6}$$

$$= -66550 \text{ ft.-lbs.}$$

$$A_s \text{ (at bottom)} = \frac{68450 \times 12}{10760 \times 7.5 \times 12} = 0.85 \text{ sq. in. per ft.}$$

$$A_s \text{ (at top)} = \frac{66550 \times 12}{10760 \times 7.5 \times 12} = 0.83 \text{ sq. in. per ft.}$$

Direct tension. Pressure on roof = (80 + 20 (surge)) × 62.5
=6250 lbs. per sq. ft.

Upward pressure...........6250 × 4.5........= 28150 lbs.
Weight of concrete in roof = (4.5+4)×12×140...= 14300 "
Net uplift at top...........................= 13850 "
Weight of concrete in wall = 4 × 16 × 77.5....= 4960 "
Net uplift at bottom........................= 8890 "

$$A_s \text{ (at top)} = \frac{13850}{12000} = 1.16 \text{ sq. in. per ft.}$$

$$A_s \text{ (at bottom)} = \frac{8890}{12000} = 0.74 \text{ sq. in. per ft.}$$

Total reinforcement in side wall per foot,
At top 0.83 + 1.16 = 1.99 sq. in.
At bottom 0.85 + 0.74 = 1.59 sq. in.

(3) Diaphragm

Upward pressure.........................= 6250 × 7.5 = 46900 lbs.
Weight of concrete in roof............= 7.5 × 12 × 140 = 12600 "
Net uplift at top..................................= 34300 "
Weight of concrete in diaphragm.......= 3 × 16 × 77.5 = 3700 "
Net uplift at bottom...............................= 30600 "

$$A_s \text{ (at top)} = \frac{34300}{12000} = 2.86 \text{ sq. in. per ft.}$$

$$A_s \text{ (at bottom)} = \frac{30600}{12000} = 2.55 \text{ sq. in. per ft.}$$

(4) Hoops

To determine the sectional area of the hoops required in the walls the scroll-case is assumed to be split on the longitudinal centre line.
Area of section = 609 sq. ft.
C.G. = 20.2 ft. from right hand side looking toward intake.
Total pressure = 6750 × 609 = 4,110,000 lbs.

$$A_s \text{ (right hand side)} = \frac{4{,}110{,}000 \times 23.8}{44 \times 16000} = 139 \text{ sq. in.}$$

$$A_s \text{ (left hand side)} = \frac{4{,}110{,}000 \times 20.2}{44 \times 16000} = 118 \text{ sq. in.}$$

The hoops project into the intake structure far enough to provide adequate anchorage for the scroll-case.

Draft-Tube

The weight of the generator, exciter and turbine runner and the hydraulic thrust are carried to the foundation through the stator frame, speed ring and draft-tube cone and cast steel vanes.

The reinforcement of the draft-tube is simple, consisting of radial bars near the bottom of the roof to take the bending tension due to water pressure in the scroll-case,

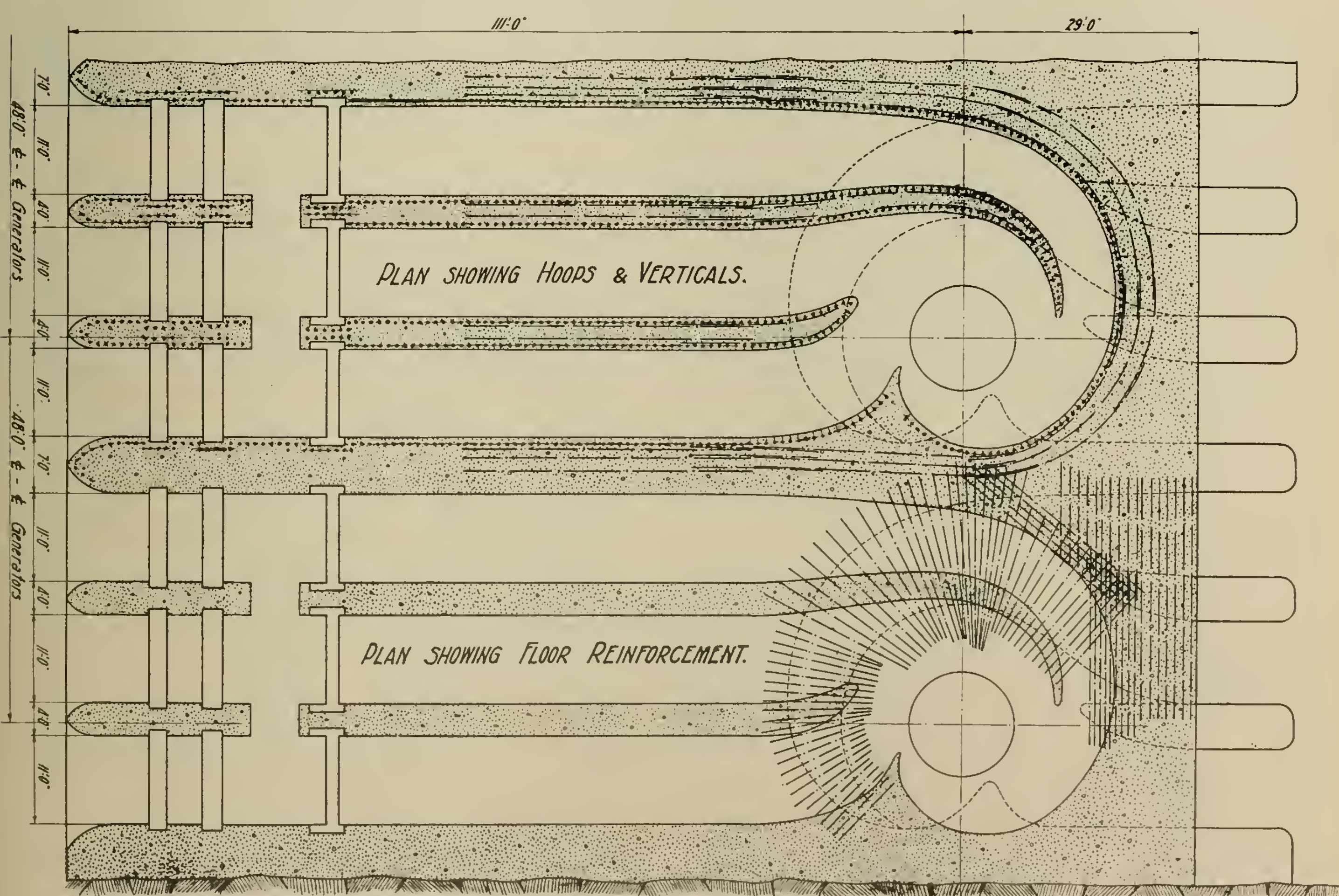


Figure No. 7.—Chelsea Power House Substructure—Cross-section Through Intake and Scroll-case.

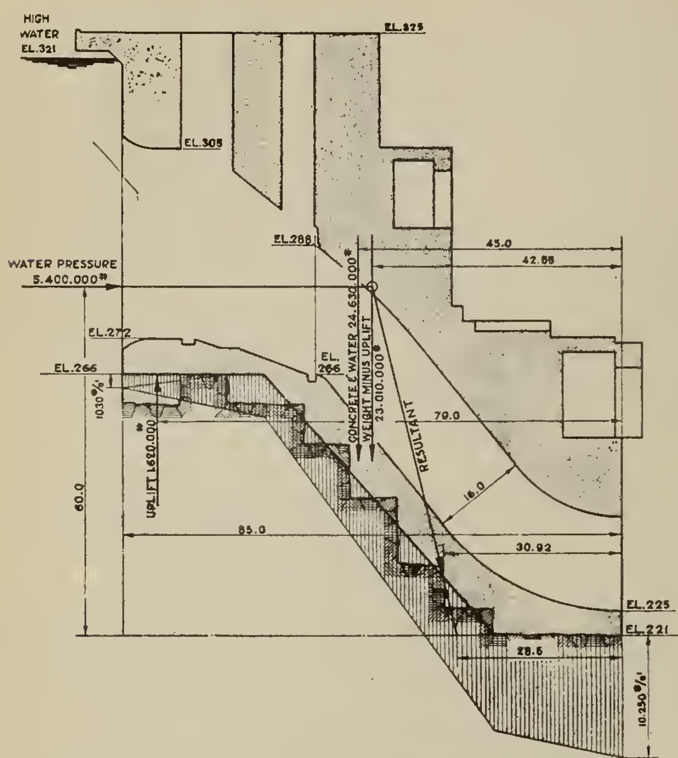


Figure No. 8.—Chelsea Power House—Intake Block.

vertical bars in the dividing walls between draft-tubes to take bending tension due to hydrostatic pressure in case one draft-tube is unwatered, and some hoops near the outside of the draft-tube bell. These hoops are necessitated by the fact that a slight eccentricity exists between the centre of the draft-tube vanes and the centre of the load.

The use of cast steel vanes to support the bell of the draft-tube has considerably simplified the reinforcement of the Moody draft-tube, especially in large units. The diagram shows a comparison between the reinforcement of the Chelsea draft-tubes and that for the 41,000 h.p. turbine at Shawinigan Falls. The dimensions of the Chelsea draft-tube are slightly smaller, but the amount of reinforcement required is negligible in comparison with that required for the Shawinigan draft-tube. At the time the Shawinigan installation was being designed the engineers suggested the use of supports under the draft-tube bell, but the turbine manufacturer would not sanction their use owing to lack of information as to the effect that the supports would have on the efficiency of the machine. Subsequent tests on models showed that the efficiency of the draft-tube was not impaired by the use of these supports.

In passing, it may be interesting to note another development in the Moody draft-tube that was suggested by the operation of the Shawinigan unit. It will be noted by reference to the diagram that the baffle in the Shawinigan draft-tube is at the back on the transverse centre line. After the machine was placed in operation it was noticed that most of the water was discharged from the right-hand opening. This is due to the fact that the water in the draft-tube has a clockwise whirl and tends to pile up against the baffle in the left-hand passage. In undertaking, shortly afterward, the design of the Manitoba Power Company's plant at Great Falls, the Shawinigan Engineering Company suggested the placing of the baffle at the left-hand side of the draft-tube, and tests conducted by the manufacturer showed improvement in its performance.

Areas of Water Passages

It is the aim of the designer to so proportion the water passages that the water entering the intakes at a low velocity will be speeded up gradually to the turbine runner and then the velocity gradually reduced to the draft-tube exit. At the entrance to Chelsea intakes the water has a velocity of 3 feet per second; through the racks about 4.5 feet per second, and at the head gates a little over 5 feet per second. From the headgates the velocity gradually increases to the

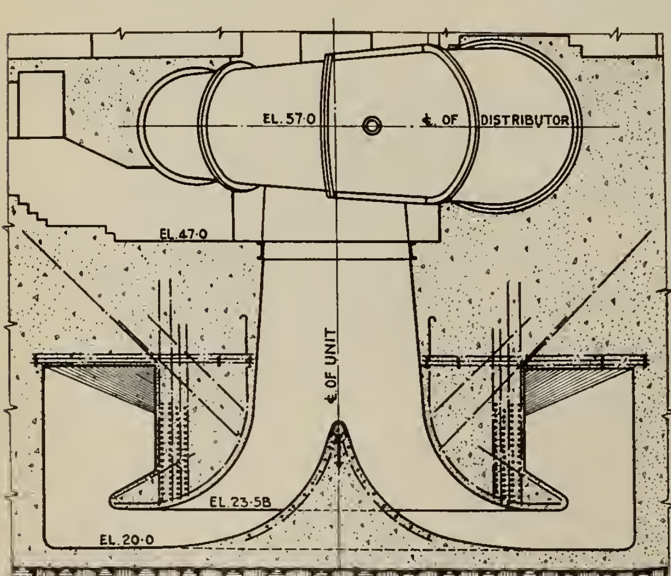


Figure No. 9.—Longitudinal Section—Scroll-case and Draft-tube, No. 6 Unit at Shawinigan Falls.

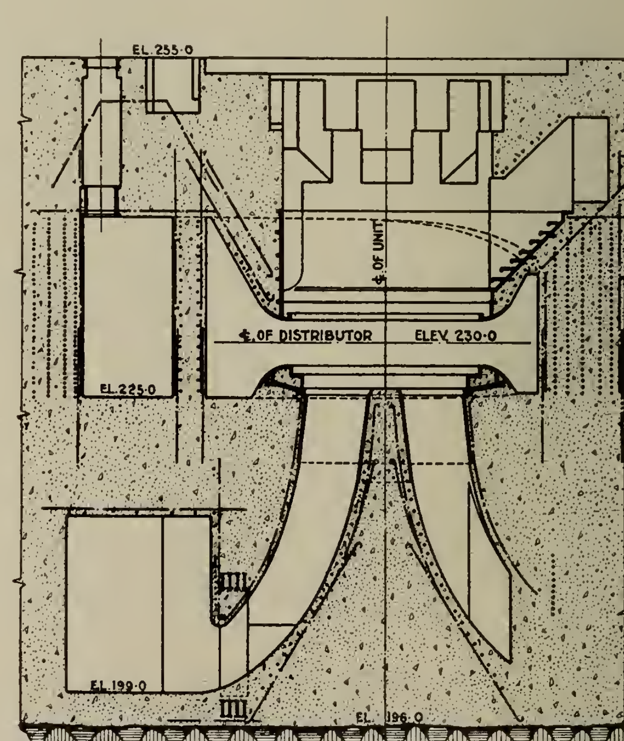


Figure No. 10—Longitudinal Section—Scroll-case and Draft-tube at Chelsea Development.

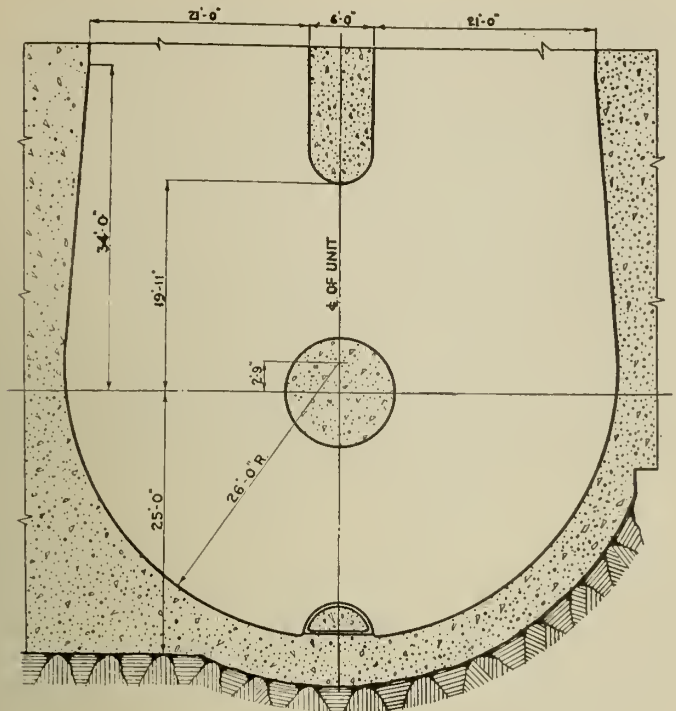


Figure No. 11.—Plan of Draft-tube, No. 6 Unit at Shawinigan Falls.

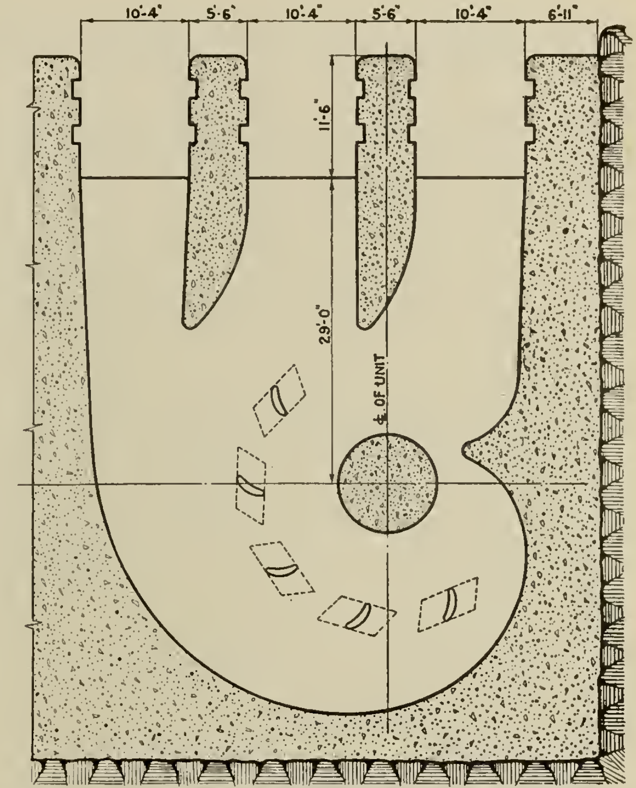


Figure No. 12.—Plan of Draft-tube at Chelsea Development.

scroll-case, where it is 7.3 feet per second. In the scroll-case the velocity is still further increased to about 18 feet per second at the speed ring. Below the turbine runner the speed of the water is gradually reduced until it emerges from the draft-tube at a velocity of 4 feet per second.

Conclusion

In the foregoing, the writer has endeavoured to give a general description covering the important features of the three power developments of the Gatineau Power Company, together with an outline of the steps taken in the reinforced concrete design of the Chelsea power house. He has also indicated the relation of the three plants to each other in a system, the importance of which to the district in which it is located is evidenced by the fact that it will be capable of delivering continuously 300,000 h.p. of electrical energy, and when the final units have been installed will have a peak load capacity of more than twice this amount.

The ground covered is so extensive that each of the four more important phases of the design, hydraulic, mechanical, electrical and structural, could be amplified into a fairly extensive paper, so that this paper must be considered as merely a summary of the important phases of these developments.

The writer is indebted to Messrs. S. S. Scovil, M.E.I.C., F. B. Brown, M.E.I.C., and O. O. Lefebvre, M.E.I.C., and to the Fraser-Brace Engineering Company for information and data which they have very kindly given him and which has assisted materially in the preparation of the paper.

Building an Industrial Plant in the Saguenay District

Preliminary Investigations, Design and Layout of Buildings and Construction Features of the New Plant of the Aluminum Company of Canada, Limited, at Arvida, Que.

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Paper presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

During the past five years the development of the Saguenay and Lake St. John districts has attracted the attention of the entire province of Quebec as well as a large part of the eastern sections of Canada and the United States. The pulp and paper industry in this district has made rapid strides. The development of hydro-electric power has advanced even more rapidly. A few years ago the question arose in the minds of many, "How is this enormous amount of power to be absorbed?" This question was answered slightly over a year ago when the Aluminum Company of Canada, Limited, commenced the construction of its new plant at Arvida, which will absorb the surplus power that is now developed and is destined to form the basis for even larger water power developments in the future.

Arvida is located on the Canadian National Railway, about six miles west of its terminus at Chicoutimi. Fifteen months ago it consisted of a name and a considerable number of red painted stakes driven in the ground by survey parties. At that time the site now occupied by the plant and the two hundred and seventy employees' houses was partly under cultivation and partly wooded. At the time of this writing the plant is nearing completion and over half of the two hundred and seventy houses, comprising the new town, are occupied by the plant employees and their families.

Preliminary Operations

During the summer of 1925 an extensive topographic survey was made, covering a tract of about nine square miles at and around the plant site. In addition to this, numerous test pits were dug in order to determine the depth from the surface of the ground to solid rock. These tests proved conclusively that to attempt to secure a rock foundation for any of the plant buildings would be out of the question. It was therefore necessary to provide a sufficient bearing area for all foundations, so that a uniform pressure on the yielding soil would be provided throughout, in order to prevent unequal settlement. Obviously the next step was to determine the nature of the soil and the unit pressure that it would withstand without excessive settlement.

This soil consists of a very fine, dense, blue clay. The percolation of water through the soil in its natural state is extremely slow. This is evidenced by the fact that in several cases two pits were excavated within a few feet of each

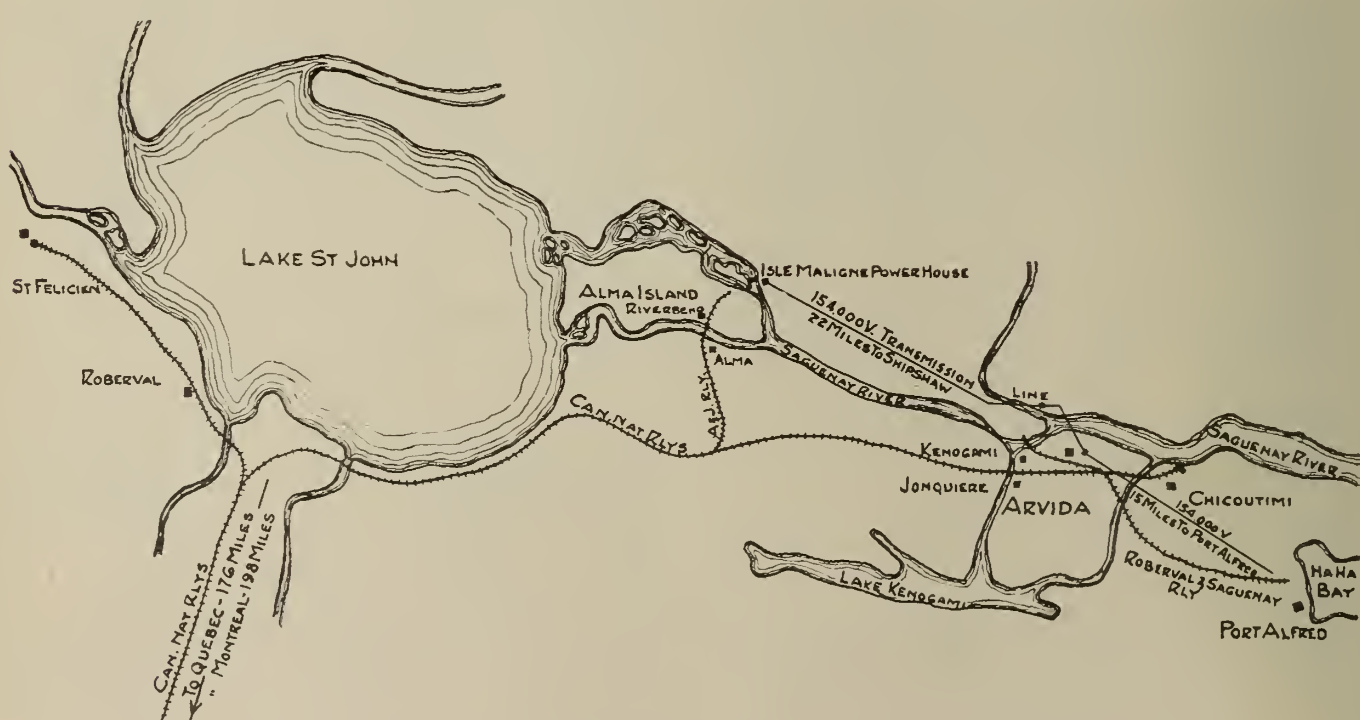

Figure No. 1.—Saguenay and Lake St. John District.

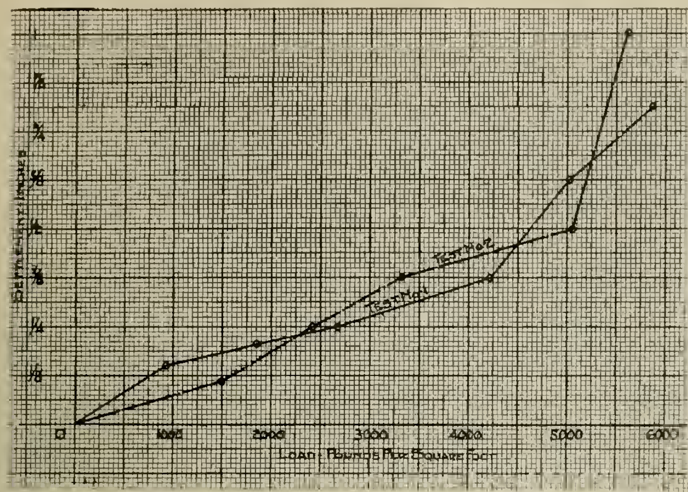

Figure No. 2.—Typical Load Settlement Chart for Soil Bearing Tests at Arvida, Que.

other and allowed to fill up with ground water. One pit was then pumped dry and kept in that state with a small hand pump. The lowering of the water in the adjacent pit was barely perceptible even over a period of several days. It was also noted that in its natural state this material has a very high moisture content. Samples were taken from a few feet below the surface and dried out. A shrinkage of about 20 per cent by volume and a loss of over 50 per cent by weight was noted in some cases. On account of the slow percolation of water through the soil it was decided that it would be useless to attempt to eliminate the moisture by means of sub-drainage prior to the construction of building foundations. It was also evident that any attempt to do so after the foundations were built would only result in a high shrinkage and consequent settlement.

The determination of the safe bearing power of the soil was accomplished by excavating a number of shallow pits at various points around the proposed plant site, loading the soil at the bottom of the pit, and measuring the settlement as the loading progressed. These pits were about fifteen feet square by three feet deep. In the centre of the pit a pedestal having a bearing area of sixteen square feet was built of 12- by 12-inch timbers, placed in four layers, running in alternate directions. This placed the top of the pedestal approximately one foot above the original ground surface. This elevation was carefully noted, and a wooden bin having a capacity of 1,000 cubic feet was then built on top of the pedestal and gradually filled with clay. The weight of the bin as well as the weight per cubic foot of the clay were predetermined, and the settlement was measured at frequent intervals throughout the process of loading. These tests were made when the soil was very wet after heavy rains, and also under comparatively dry conditions. The time element was also considered, the structure being allowed several days to settle under various loadings before taking final measurements. Some of the typical load settlement curves are shown in figure No. 2. After a careful study of these charts, it was decided that a unit bearing pressure of 3,500 pounds per square foot could be used without danger of unequal or excessive settlement, and this figure was used as a basis for the design of foundations.

Description of Plant

The layout of the plant buildings now under construction as well as proposed future extensions is shown in figure No. 3. The Arvida works consist essentially of an aluminum plant and a carbon plant. In addition to this there are the following auxiliary buildings:—

A high-tension transformer building, containing six 25,000-kv.a. transformers with a stepdown from 154,000 to 13,200 volts.

A rotary station, containing eighteen synchronous rotary converters for converting from alternating to direct current, and also nine 7,500-kv.a. transformers on the alternating current side with a stepdown from 13,000 to 440 volts. Direct current at 600 volts is taken from this building to the aluminum plant.

A pumping station and spray pond for circulating water for cooling the transformers.

An office building with 27,000 square feet of floor

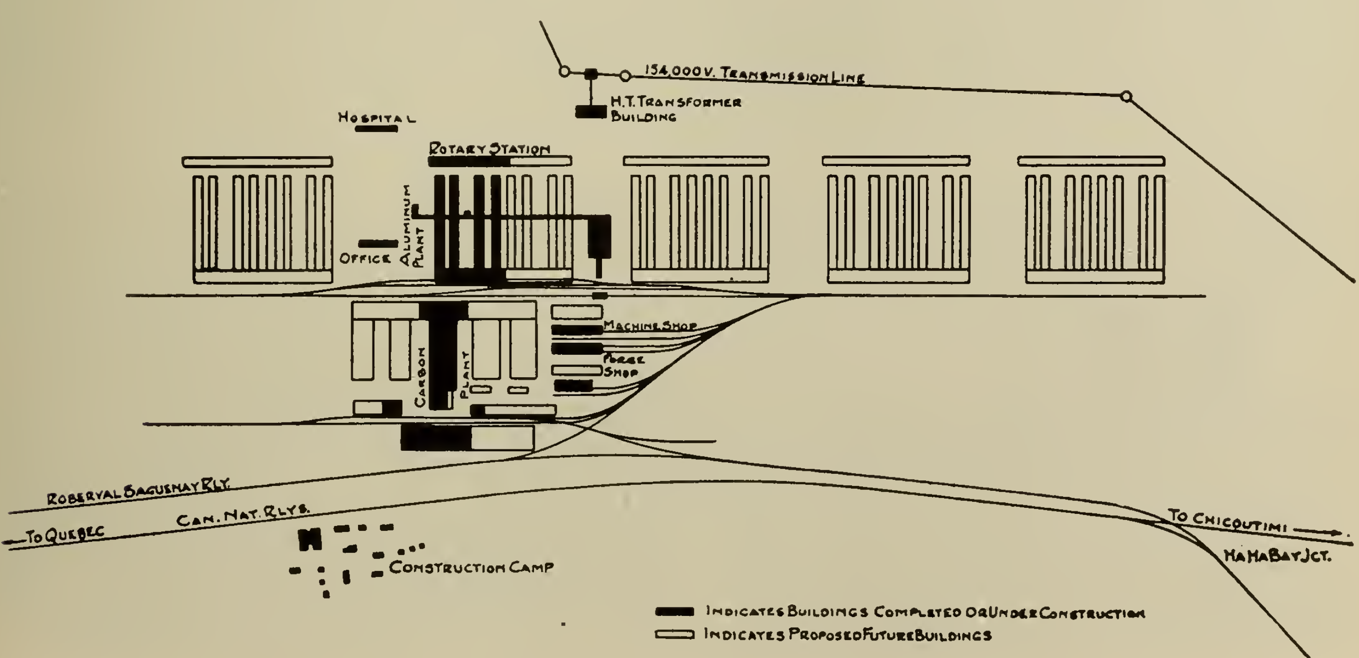

Figure No. 3.—Layout of Plant.

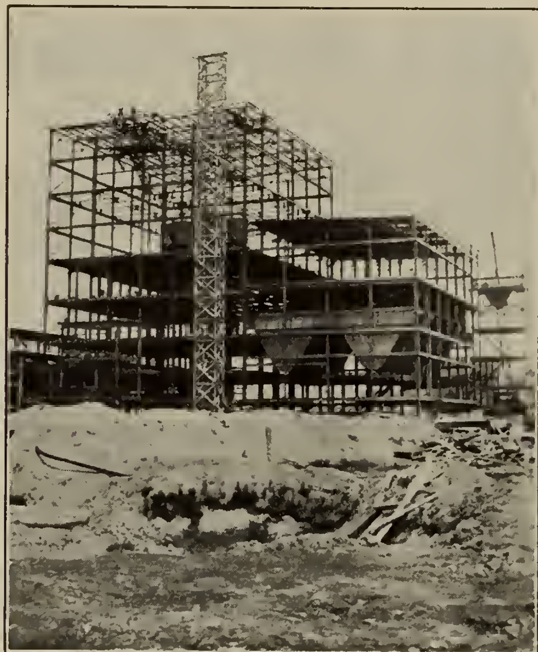

Figure No. 4.—Carbon Plant Buildings Under Construction.

space which will accommodate the operating staff and will contain a large laboratory for analysis of metal as well as the various materials entering into the manufacture of carbon electrodes and aluminum.

A hospital with modern equipment which will serve the plant employees and their families.

A group of service buildings consisting of a machine shop, a forge shop and a building for lining the furnaces which are used in the aluminum plant.

The present installation, so far as the aluminum plant is concerned, consists of four furnace rooms and a service building for handling and storing materials entering and leaving the furnace room. This building connects to one end of each furnace room. There is also a group of buildings located near the furnace rooms for unloading, storing and reloading ore to be transported to the furnace rooms. Each furnace room contains the electric furnaces in which aluminum is plated out from refined bauxite ore by an electrolytic process. The furnaces are connected in series to the main bus which runs through the centre of the building. Carbon electrodes are suspended in the furnaces, and these form the anode for the direct current which is used in this process. The cathode is formed by the carbon lining in the furnaces.

Refined bauxite, which is practically pure aluminum oxide having the appearance of a very fine white sand, is placed directly in the furnaces with a small amount of cryolite which acts as a solvent and electrolyte. When the current is applied the aluminum gradually plates out in the bottom of the furnaces, remaining in a molten state, the cryolite remaining at the top. Additional ore is applied at frequent intervals, the entire process being a continuous one. The furnaces are tapped through an orifice near the bottom, and the molten metal is allowed to flow out into a crucible. It is then transported by an electrically-operated overhead crane into one end of the building, poured into cast steel pig moulds and allowed to cool. A sample is taken from each pouring and analyzed in the laboratory. Each pig is then marked with a symbol which indicates the grade of purity of the metal. The metal is then ready for shipment, since no fabrication of any kind is done at Arvida.

The carbon plant, which consists of eight large buildings, is used for the manufacture of carbon electrodes. No doubt many will wonder why such a large installation is necessary in order to supply one accessory for four productive buildings. This is readily explained by the fact that it requires a very large number of electrodes to equip one furnace room, and the life of these is comparatively short.

The raw materials entering into the manufacture of carbons are petroleum coke and crude pitch. Petroleum coke is brought in during the shipping season, crushed and placed in storage in a large building having a floor area of about one and one-half acres. It is reclaimed from this building when needed by means of a drag line bucket, taken into another building and put through a calcining process in order to drive off the volatile gases. It is then carried by means of a belt conveyor into a grinding building and ground into dust. Crude pitch is likewise placed in a storage building, reclaimed as needed, and crushed and ground. The coke and pitch are then mixed in electrically-operated mixers. The mixture is next taken to large hydraulic presses and moulded into the shape of the electrodes under an intense pressure. The carbons are then placed in electric baking furnaces and thoroughly baked. After being baked they are taken into another building in order to make the

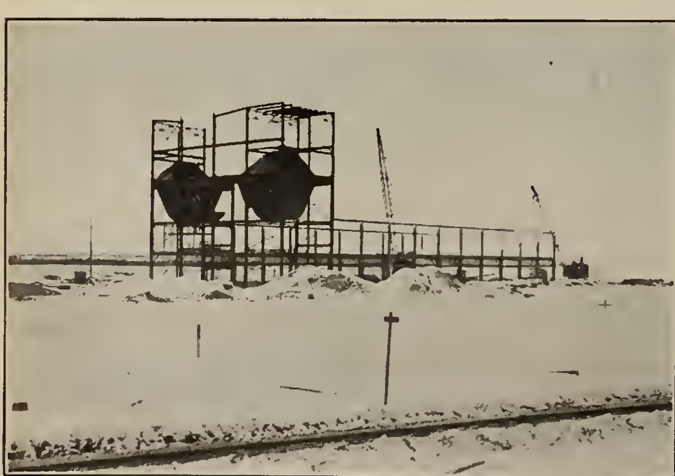

Figure No. 5.—Steel Framework for Pot Lining Building.

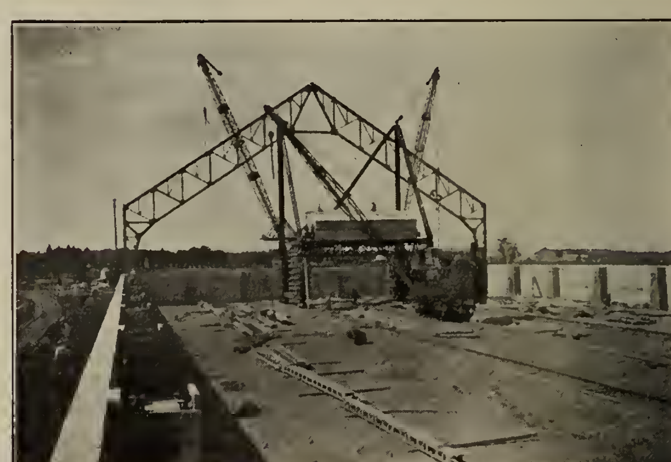

Figure No. 6.—Erection of Steelwork for Coke Storage Building.

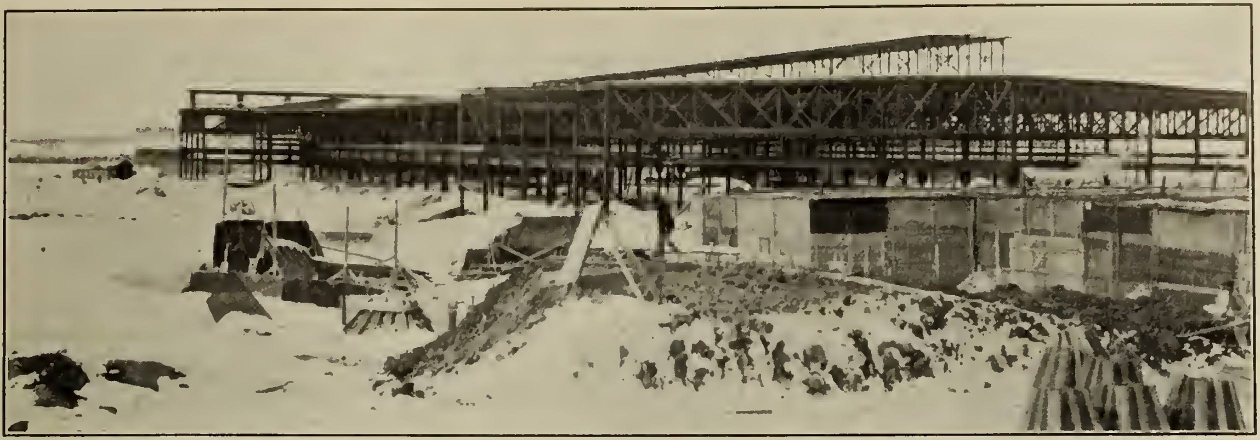

Figure No. 7.—Carbon Plant Buildings Under Construction.

electrical contact to them by means of which they are suspended over the furnaces. The electrodes are then transported into the furnace rooms and bolted on to the copper suspension rods.

Design of Plant Buildings

The general design of the plant buildings at Arvida does not differ materially from that which may be found at numerous other large manufacturing plants. All outside walls are placed on concrete foundations extending to a depth of six feet below the surface of the ground. The walls are of brick construction and framework of structural steel. The majority of the buildings contain electrically-operated travelling cranes varying in capacity from five to seventy-five tons. The carbon plant buildings contain numerous and varied types of conveyors, elevators, and other machinery for handling materials. Several of these buildings also contain large bunkers and tanks for the storage of materials, all of which are located in the upper part of the structure at a distance of from 60 to 75 feet above the ground. The steel framework for some of the buildings of this type is illustrated in figures Nos. 4 and 5. Special attention was given to the design of the framework for these buildings on account of the fact that the Saguenay district is known to be one in which frequent earth tremors occur. In the past few years a number of these disturbances have taken place. While they are not usually considered of sufficient magnitude to cause any serious damage to steel frame buildings, it will be noted from the illustrations that the principal mass in these buildings consists of the bunker. When filled with ground coke, pitch or other material the inertia of this mass is considerable. It was feared that any subterranean disturbance, transmitting its effect to the building through the column footings, would have a tendency to shear the columns at some point below the point of suspension of the bunker. Consequently, in addition to the wind bracing which is ordinarily placed in structures of this class, heavy diagonal bracing was placed wherever possible, without interfering with the operation of machinery within the building. Columns were also tied together at the base by placing steel reinforcing bars in the wall foundations, extending from one column foundation to the next.

A peculiar problem also arose in connection with the design of the building for the storage of petroleum coke. The steel framework for supporting the roof of this building consists essentially of fifteen three-hinged arch trusses, as illustrated in figure No. 6. These trusses have a span of 150 feet and are supported on reinforced concrete piers of cantilever construction, extending twelve feet above and seven feet below the ground surface. The horizontal thrust at the two lower extremities of these trusses is extremely high. This naturally produces both an overturning and a sliding effect on the concrete piers. The overturning effect was considered quite serious on account of the fact that any inequalities in the distribution of pressure across the pier foundation would cause unequal settlement and consequently a spreading of the lower extremities of the truss and a lowering of the ridge of the roof. The sliding effect was

Figure No. 8.—Construction of Rotary Station Under Winter Conditions.

equally as serious on account of the very low coefficient of friction between concrete and wet clay and also on account of the doubtful bearing capacity of the clay soil in a vertical plane, particularly after it has been disturbed from its natural state by excavation and backfilling. This problem was solved by tying together the opposite piers with heavy steel rods just below the floor surface and extending across the entire width of the building. These were then encased in concrete to prevent rusting.

The usual problems encountered in cold climates in connection with heaving on account of frost penetrating in the soil were given a careful study. In unheated buildings, all foundations for machinery and equipment were extended to a depth of five or six feet below floor level. The clay soil was also excavated for a depth of four feet below floor level and backfilled with sand up to the subgrade level for the floor.

Construction Operations

With the exception of cold weather operations, the principal problems in connection with the construction work were the proper scheduling of the work and selection of equipment. On account of the fact that concrete operations were quite scattered, this work was done with small mixers of one-half or one-quarter cubic yard capacity. In some cases a complete mixing plant was placed on an ordinary railway flat car and transported from place to place by means of a locomotive. The mixer and steam boiler were mounted on the car and housed with a wooden structure. This left sufficient space for a small quantity of cement, sand, crushed rock and coal for the boilers, and formed a complete portable unit for small concreting operations.

The various problems and hazards of winter construction are well known to the majority of Canadian engineers. However, the operations at Arvida are noteworthy on account of the fact that nearly every class of work was carried on during the winter months. Naturally, excavation presented the first problem, owing to a frost penetration of four or five feet. In some cases, where there was no danger of damage to nearby structures, the frozen crust of earth was broken with dynamite and shovelled out by hand. A wooden structure was then built of scrap lumber covering the site of the foundation. A structure of this type is shown at the lower right-hand corner of figure No. 7. This structure was heated with wood stoves or salamanders and both excavation and concrete work carried on inside, the men working under cover. In all cases, particular care was exercised not only to prevent freezing of the concrete before allowing a sufficient time for setting, but also to prevent freezing of the subsoil prior to the time of backfilling. The methods of covering the concrete work with tarpaulins and placing steam pipes under them, as well as double forming, with steam pipes inside, was tried. However, it was found that wherever there was any appreciable amount of work to be done, the method of housing the structure completely proved more economical on account of the greatly increased efficiency of labour, the men working in what practically amounted to a heated building. The fact that better results were secured is also unquestionable.

The use of calcium chloride as a preventative of freezing in concrete was also tried. This was placed in the mixer with the aggregates, in the proportion of about 6 pounds to a one-half cubic yard batch. It was found that at extremely low temperatures the other means of protection outlined above could not be dispensed with on account of its use, However, the use of calcium chloride unquestionably accelerates the setting of cement and reduces the length of time during which it is necessary to protect the concrete from frost action. In the opinion of the writer, it is not to be recommended for structures of reinforced concrete owing to the fact that its effect on reinforcing steel is at least questionable.

Work on the brick walls of the buildings at Arvida was started in November 1925, and was carried on continuously throughout the winter months with the exception of a few extremely cold days. During cold weather, both sand and water for the mortar were heated with steam and calcium chloride was added in the mortar mixer. Great care was taken to see that no frozen bricks were placed in the walls, but no attempt was made to protect the work from frost after the bricks were laid in place. A careful inspection was made during the following summer and no signs of buckling, deterioration of mortar, or other defects were observed. The fact that brickwork can be successfully carried on throughout the winter months at no great increase in cost was very clearly demonstrated. Also, the fact that the services of good bricklayers are much more readily obtained during the winter months, is an important item in favour of carrying on this work throughout the cold season.

Protection Against Seepage at Lake Kenogami

Preliminary Investigations, Features Governing Choice of Type of Dam, Construction Methods and Records of Results Attained

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Paper presented at the Annual General Professional Meeting of The Engineering Institute of Canada, at Quebec, Que., February 15th to 17th, 1927

Lake Kenogami is a body of water located south of the towns of Chicoutimi and Kenogami. It has a drainage area of 1,400 square miles and flows into the Saguenay by two outlets, namely, the Chicoutimi river flowing past the town of Chicoutimi, and the Au Sable river flowing past the towns of Jonquière and Kenogami. The elevation of the lake above the Saguenay river, which is a tidal stream, is slightly over 500 feet. This fall is concentrated in a distance of about seven miles on the Au Sable river and fifteen miles on the Chicoutimi outlet.

In order to assure the power owners on both outlets of a steady flow the water was impounded in lake Kenogami, the surface of which was raised from low water elevation 83 to elevation 115. This assures a capacity in the reservoir of thirteen and a half billions of cubic feet. With this reserve it is possible to regulate the flow out of the lake to 1,200 second-feet on the Chicoutimi river, and 600 second-feet on the Au Sable river. In addition to the two control dams in the two outlets, dykes were built at six other points in order to prevent the water from being diverted into the adjoining watershed.

When the survey of the lake was made to determine the maximum level to which it would be possible to store water, the governing factors were the area to be flooded and the number of dykes required across the gulleys, ravines, creeks, etc. It was found that level 115 was the maximum to which the water could be raised. Above that point the cost of the dykes became excessive.

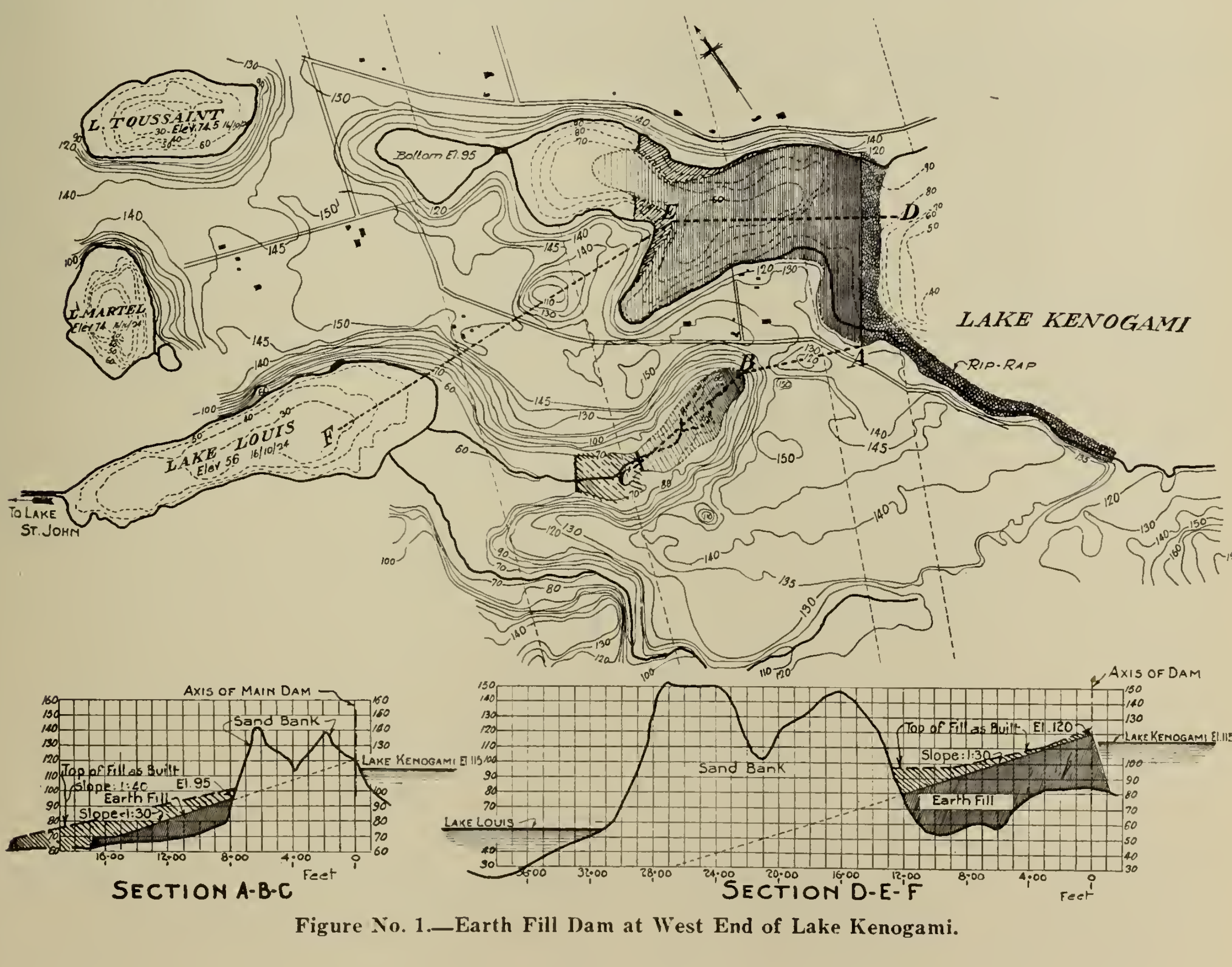

Figure No. 1.—Earth Fill Dam at West End of Lake Kenogami.

Lake Kenogami watershed is separated from the lake St. John watershed by a sandy bank having a minimum width of about 600 feet, and an elevation of 150 and more. An examination of this bank failed to alter the engineers' opinion that no additional work was required at that point. However, during the summer of 1924, the lake level was raised to elevation 102, and it was found that at that stage seepage was taking place through this bank to such an extent that it would be absolutely unsafe to raise the level of the lake an additional 13 feet without protecting the bank.

An examination of the nature of the ground by borings showed that sand was present as far down as elevation 38, or 64 feet below the level of the lake. The borings were not carried any deeper. No impervious bottom was available on the lake Kenogami side of the bank. On the lake St. John side of the bank, however, three-quarters of a mile from the lake, a clay foundation exists. Borings were carried in it to a depth of 90 feet and rock was not encountered. This clay formation stands at an elevation of about 100 on the plateau, and about 50 in the valley of the creek flowing into lake St. John. A dam at that point would have to be quite long, almost a mile, and about 80 feet high. The cost of such an earth bank would have been very high and the structure not without danger. This plan was soon abandoned and the problem was solved by enlarging the natural bank from both sides. On the lake Kenogami side a long and narrow bay was filled and on the lake St. John side a deep and narrow ravine was partly filled.

The principle governing this design is that the surface slope of the fill must cover the line of saturation at which the velocity of the water through the fill will be so small that no chance exists of any particle of material being carried away. The hydraulic gradient through the bank was determined by borings and was found to be in the ratio of 1 in 30.

It was then decided to arrange the fill so that its surface slope would be 1 in 30 or thereabout, and that the bank would have a width such that this slope of 1 in 30 would lead beyond the lowest points on the lake St. John side of the bank.

It was decided also that the surface of the fill should be at elevation five feet above the hydraulic gradient. This decision was made with the approval of S. H. Woodard, M.E.I.C., consulting engineer, who inspected the site in August, 1924. In order to determine what effect such a dyke would have, advantage was taken of a narrow gorge near the head of the bay in lake Kenogami, to construct at that point a sand bank so as to separate part of the bay from the lake. This sand bank was about 100 feet wide. Immediately after it was completed the part of the bay separated from the lake gradually drained off from level 102 down to ground level 95. This showed that the bank from this bay to the small lakes below was quite pervious and the sand fill proposed could hold the water at a certain head.

This seepage was observed in June, 1924. A careful survey of the bank and the lakes on the downstream side was made. The surface of these lakes stood then at elevation 74.5 for lake Toussaint, 74 for lake Martel and 56 for lake Louis. It appears that under natural conditions, lake Toussaint stood at elevation 70, lake Martel at elevation 73 and lake Louis at elevation 55. Complete records of the levels of these lakes have been kept since 1924.

The work of reinforcing the bank by an earth fill was carried out under contract. The material used was that available on the shores and on the top of the bank itself. Part of the fill was made by steam shovels and dump cars, and part of it was made by hydraulic sluicing. The hydraulic machinery was operated by electric power which was transmitted from the municipal plant of the town of Jonquière, a distance of twenty-one miles. A transmission line was built specially for that work, and the amount of power used was about 1,200 h.p.

The contract was awarded in September, 1924. The steam shovel work was commenced at the end of October, 1924, and continued day and night all through the winter. The hydraulic machinery was working for a few weeks in the fall of 1924, but had to be stopped during the winter. In April and May this sluicing process was used again with excellent results. As much as 350,000 cubic yards of material were sluiced in the month of April, 1925. The fill was completed early in May, 1925, and the lake Kenogami water was allowed to rise against it. The lake water reached its maximum height, elevation 114.9, on June 24th, and the fill did the work that was expected of it.

In order to ascertain under what conditions the water was acting in this fill, a series of pipes were left in the fill. Water rises in these pipes and its level may be measured very accurately. These elevations show that this sand bank gets partly saturated very slowly; the change in the water level being hardly noticeable from day to day. A comparison of observations separated by about a month, however, shows that the hydraulic gradient has risen during that time to quite a small degree, and that this movement of the water tending to adjust itself to a point where the resistance of the material in the fill prevents the water from any further movement, is very slow,—as shown by the following table:—

Water Level in the Earth Fill—Head of Lake Kenogami

(Station 25 being that next to the lake)

Date	Sta. 18	Sta. 19	Sta. 20	Sta. 21	Sta. 22	Sta. 23	Sta. 24	Lake Ken.
June 22..	...	...	103.40	105.60	107.10	108.90	111.00	114.83
July 22..	102.50	104.31	105.53	106.95	108.30	109.95	111.67	114.53
Aug. 21..	102.38	104.03	105.37	106.79	108.16	109.84	111.98	114.15

The aggregate amount of seepage which was measured in 1924 when lake Kenogami level was 102, was 23 cubic feet per second. Under these conditions, the level of lake Toussaint rose to elevation 77.2, that of lake Martel rose to 75 and lake Louis to elevation 56.

As a result of the construction of the small sand bank across the gorge, as mentioned before, the level of lake Toussaint decreased to elevation 74.5 on the 16th of October, 1924. In 1925, after the fill was completed and lake Kenogami had been raised to elevation 115, the level of lake Toussaint reached 74.8, that being 2.43 feet less than the level that lake had with water at elevation 102 in lake Kenogami prior to the completion of the fill.

Similar results were observed as to lake Martel. Lake Louis was lowered by about six inches and the total amount of seepage was reduced from 23 second-feet to about 13 second-feet.

Observations of water levels in the small lakes which are separated from lake Kenogami by a natural bank and the artificial bank added to it, show clearly that the movement of the water in this bank is exceedingly slow. For example, in 1926, lake Kenogami began to rise on the 1st of May when its level was 83, and on the 31st of May it stood at elevation 112.5, a rise of 29.5 feet. During the same period the level of the water in the bay separated

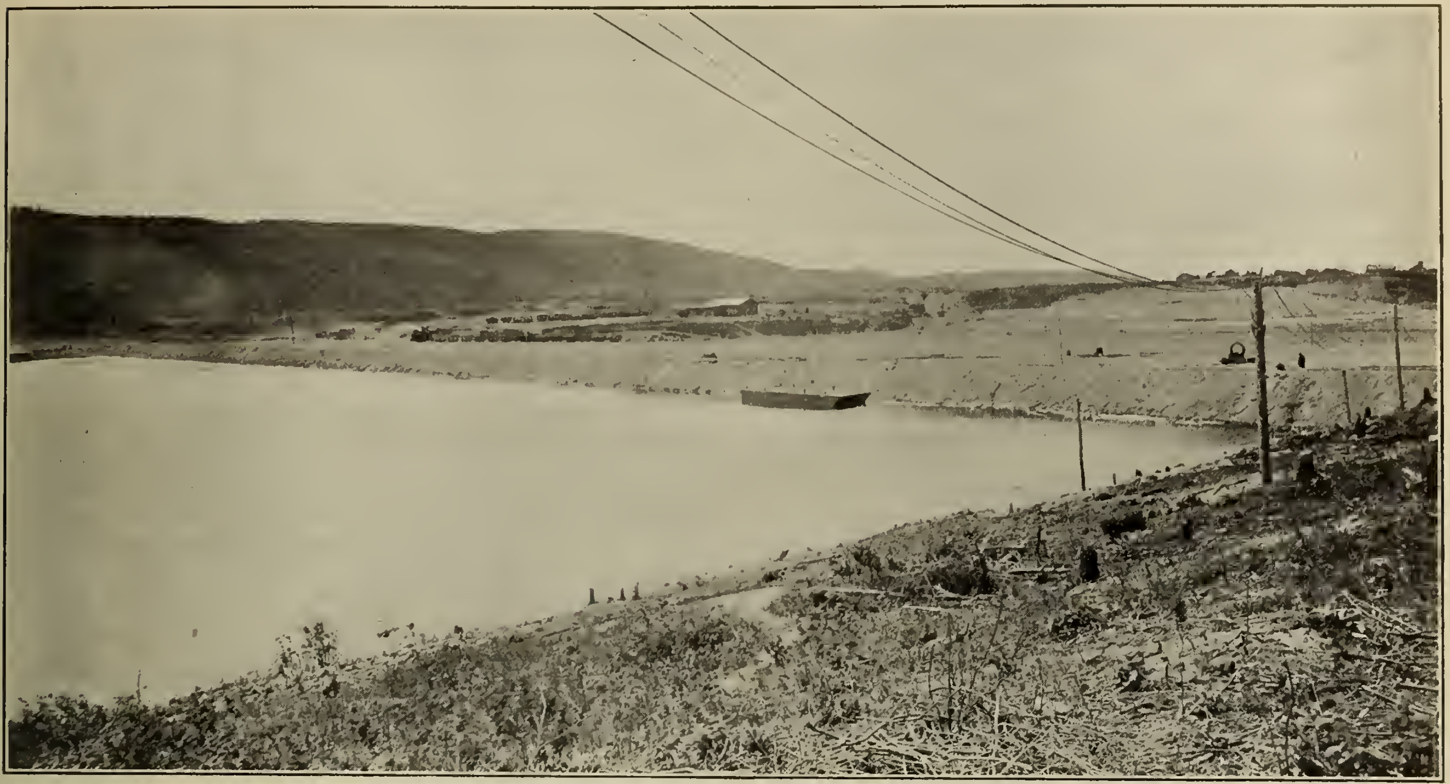

Figure No. 2.—General View of Dam From Lake Side.

from lake Kenogami by the earth fill practically did not change and remained at elevation 89. On the 1st of June it began to rise, and on June 20th, when lake Kenogami was practically full at 114.8, the level in this bay had risen 2½ feet. From June 20th to July 20th, though lake Kenogami level did not change, the level of the bay rose from 92½ to 96½, a rise along a straight line. The level in this bay reached its maximum on August 30th at 97.5, so that, while lake Kenogami was raised 29½ feet in the month, the level in the bay was not changed during that month. In the next month the level of the bay rose three feet and again in the next month practically another four feet. The rise in the lake was 32 feet and the rise in the bay was 8½ feet.

It will be interesting to note that very little settlement occurred in the material sluiced into place. A settlement varying from three or four feet to a few inches, according to the depth of the fill, took place in the material deposited from dump cars. About two million yards of material were put into this fill, and the average cost per yard was 42½ cents.

The original plans provided for a stone rip-rap three or four feet deep, covering the face of the fill on the lake Kenogami side, so as to protect the bank against erosion by wave action.

In the winter of 1925, while excavating, a gravel pit was found which contained a large proportion of boulders mixed with the sand. A survey of this pit showed suitable material for protection of the bank against erosion, and it was decided not to put in the stone rip-rap and substitute this very heavy gravel, which could be handled almost at the same price as earth. A depth of 25 feet of this material was dumped on the lake face of the bank and has proved to be quite effective as a protection.

Report of Council for the Year 1926

The improvement in industrial conditions occurring in Canada during the past year has not only resulted in an increased measure of general prosperity in the country, but has also been reflected in better conditions as regards the employment of engineers of practically all branches of the profession. It is encouraging to note the spectacular industrial developments which have taken place in the field of hydro-electric power engineering and in the pulp and paper industry; these have naturally influenced favourably other branches of construction work, and improvement has also been evident in the operating results of the railways and other transportation organizations.

No phenomenal developments have to be recorded this year as regards The Institute's affairs. The activities of our twenty-five branches have been well maintained, and these are The Institute's most effective means of influencing not only its own members but also the public. It is, therefore, satisfactory to record a year in which our branches, practically without exception, have carried out an enlarged programme, both as regards meetings for the interchange and discussion of professional data and information, and those other occasions, not so technical, which give opportunities for branch members to meet guests of other callings, or allied societies, and hear addresses on questions of more general interest.

Council desires particularly to express its appreciation of the unselfish work, (often done at considerable personal sacrifice), of the officers and secretaries of The Institute's branches, without which the successful operation of The Institute would be impossible and no progress could be made.

One of the most important and onerous duties of Council is in connection with the classification of applications for membership. The Institute, as the national engineering society of Canada, cannot guard too closely its well deserved reputation for careful scrutiny of applications for admission, and this has been the policy of the Council throughout the year.

It is regrettable that so far no practicable scheme has been found for enabling councillors residing at a distance from Headquarters to take an active part in the deliberations of Council. In the case of many decisions, councillors' opinions can be, and are, obtained by correspondence, but this is only a partial remedy, and it is felt that one or more meetings of Council should be held annually to which the travelling expenses of councillors from a distance would be defrayed by The Institute. Additional financial resources must, however, be provided if funds are to be available for this very desirable object of expenditure. This matter, in Council's opinion, might well be the subject of discussion at the Annual Meeting, together with other questions of Institute policy.

During the year, the Charter of the St. Maurice Valley Branch has been formally presented, and, after some unavoidable delay, the organization of this branch has been completed.

Attention is drawn to the meeting of delegates from the seven Provincial Associations of Professional Engineers held in Montreal in February last at the invitation of the Council of The Institute. The Institute is fortunate in having been the means of bringing together, for helpful mutual discussion, the representatives of these important bodies, and it is hoped that the movement thus inaugurated will result in other assemblies at which general and administrative problems of mutual interest to the associations will be further discussed and happily solved.

The part which the branches and members of The Institute were able to take in welcoming the important delegation of the International Electrotechnical Commission in April last has been a source of gratification to Council. The members of the party, all distinguished European and American electrical engineers, were cordially greeted and entertained at all points visited during their brief stay in Canada, and the Niagara Peninsula, Toronto, Ottawa and Montreal branches of The Institute took a very leading part in these activities.

During the year, Council has noted that the existing arrangements and regulations regarding the award of The Institute's prizes and medals could perhaps be modified with advantage. A special committee is now studying the matter, having regard to the fact that in certain cases prizes are offered by branches under conditions somewhat similar to those governing The Institute awards. The branches have been asked to express their views, and discussion and suggestions from members at the Annual Meeting would be welcome.

The list of members deceased during the year includes the names of an unusually large number of prominent engineers who had been active in Institute affairs, and whose loss is deeply regretted. Among these may be mentioned:—

Sir Alexander Bertram, Treasurer.
Thomas J. Brown.
James Ewing.
F. C. Gamble, Past-President.
L. A. Herdt.
Phelps Johnson, Past-President.
Martin Murphy, Past-President.

From the report of the Finance Committee, presented herewith, and from the statistics as regards membership, it will be noted that, while an unusually large number of names have been removed from the membership roll of The Institute during the year, there has been a substantial increase in the arrears of fees received; the action initiated by Council last year in dealing with arrears has resulted in some diminution in the nominal list of members of The Institute, but has placed the organization in a sounder financial condition than heretofore.

Meetings

Annual General and General Professional Meeting

The Fortieth Annual Meeting of The Institute convened at Headquarters on Tuesday, January the 26th, President Arthur Surveyer, M.E.I.C., in the Chair, and after the reading of minutes and the appointment of scrutineers and auditors, was adjourned to Toronto, where it reassembled on January the 27th, in the banquet hall of the King Edward Hotel.

The report of Council for the year 1925 was considered and adopted, together with the reports of the various committees and branches, considerable discussion taking place upon the proposed amendments to By-laws; this being followed by the valedictory address of the retiring president and the presentation to the officers of the Toronto Branch of the official Charter of the branch. The Charter was accepted and fittingly acknowledged by Professor T. R. Loudon, M.E.I.C.

The report of the scrutineers appointed to canvass the ballot for the election of officers was then submitted, after which the newly-elected President, Major George A. Walkem, M.E.I.C., took the Chair.

Four professional sessions were held, at which twelve papers were presented and discussed. Other functions in connection with the meeting included a luncheon on the first day, given by the Toronto Branch; a reception and smoker, and the annual dinner of The Institute, at which the leading speaker was Principal R. Bruce Taylor of Queen's University. The meeting concluded with a supper-dance on Friday, January the 29th. The total attendance at the meeting was five hundred and thirty-four, and the undoubted success of the whole gathering was in large measure due to the activity and excellent organization of the committee appointed by the Toronto Branch to take charge of the work.

Maritime Professional and General Meeting

A very satisfactory General Professional Meeting was held at Sydney, N.S., on August 17th and 18th under the auspices of the Cape Breton, Halifax, Moncton and St. John branches, this meeting being the sixth professional meeting held by The Institute in the Maritime Provinces.

Two technical sessions were held, the papers presented being "The Humber Developments of the Newfoundland Pulp and Paper Company," by H. C. Brown, A.M.E.I.C., and "The Characteristics and Utilization of Nova Scotia Coals," by W. S. Wilson, A.M.E.I.C., and M. W. Booth, M.E.I.C. Both papers were of an exhaustive character; they gave rise to active discussion, and it is to be noted that as a result of the discussion on the latter paper, a resolution was passed unanimously and forwarded to the Nova Scotia Government asking for the appointment of a board by the provincial government to carry on experimental investigations on Nova Scotia coals.

The social features of the meeting were equally successful, and included a luncheon, visits to the collieries, power stations and steel works, and a dinner and dance at the Lingan Country Club. On this occasion, The Institute was addressed by Mr. J. E. McLurg, vice-president, British Empire Steel Corporation, on "The Engineer in Industry"; the Hon. G. S. Harrington, minister of mines of the Nova Scotia Government, also spoke, announcing that measures had already been taken to give effect to the suggestions of the resolution above referred to.

The Cape Breton Branch was heartily congratulated by the visting members on the very effective arrangements made, and on the entire success of the meeting, both from a professional and social viewpoint.

Meeting at Estevan

Council has noted with appreciation the arrangements made by the Saskatchewan Branch for a joint meeting with the Southern Saskatchewan Section of the Canadian Institute of Mining and Metallurgy and the Saskatchewan Section of the American Institute of Electrical Engineers at Estevan, Sask., in July.

At this meeting, a number of papers of importance, including three upon the "Electrical Development of Southern Saskatchewan," "Rural Electrification in Western Canada" and "Mining in Northern Manitoba," were presented and discussed.

Accommodation was provided for visiting members on the civic camping ground, and, while weather conditions were not so favourable as might have been desired, the results of the meeting were both pleasant and satisfactory.

Joint meetings of this kind emphasize the cordial relations existing between The Institute and other technical bodies.

Branch Meetings

The activities of the various branches have been well maintained during the year, particulars being included in the accompanying reports.

Roll of the Institute

During the year nineteen twenty-six, two hundred and twelve persons have been elected to various grades of The Institute. These are classified as follows:—twenty-four Members, fifty-one Associate Members, twenty-six Juniors, ninety-nine Students and twelve Affiliates. The elections during the year 1925 totalled two hundred and twenty-nine.

Transfers from one grade to another were as follows:—Associate Member to Member, thirty-three; Junior to Associate Member, twenty-five; Student to Associate Member, thirty-two; Student to Junior, sixty-six; Junior to Affiliate, one; a total of one hundred and fifty-seven, as compared with one hundred and thirty-five in 1925.

A summary of these elections is given below. The names of those elected or transferred are published each month in the Journal, immediately following the election, and are added to the membership roll as acceptances are received.

Elections

	Members	Associate Members	Juniors	Students	Affiliates
January	2	5	4	..	4
February	..	..	..	21	..
March	3	13	5	10	..
April	2	12	4	2	1
May	4	7	3	1	2
June	2	4	3	4	..
July	..	..	..	..	..
August	..	..	..	..	..
September	6	3	2	12	1
October	4	5	2	2	..
November	..	1	1	23	3
December	1	1	2	24	1
	24	51	26	99	12

Transfers

	A.M. to M.	Jr. to A.M.	Jr. to Affil.	S. to A.M.	S. to Jr.
January	4	4	..	7	7
February	..	..	..	..	..
March	7	5	..	10	14
April	2	8	..	4	10
May	4	1	..	2	7
June	4	1	..	2	4
July	..	..	..	..	..
August	..	..	..	..	..
September	4	2	1	..	5
October	3	2	..	3	8
November	4	..	..	2	7
December	1	2	..	2	4
	33	25	1	32	66

Removals from the Roll

There have been removed from the membership roll during the year nineteen twenty-six, by resignation and for non-payment of fees, fifty-eight members; two hundred and eighty-four Associate Members; fifty-four Juniors; two hunhundred and sixteen Students; and four Affiliates, a total of six hundred and sixteen. Of this number, more than five hundred removals from the list were on account of non-payment of arrears of fees. The action in this matter, undertaken by direction of Council, has reduced the arrears of fees outstanding in our books from about $20,000 at the end of 1925 to approximately $8,000 at the end of 1926, this amount including the fees of all members in arrears for 1926 or more. Twenty-five reinstatements were effected and twelve Life Memberships were granted during 1926.

Deceased Members

During the year 1926 the deaths of thirty-eight of The Institute's members have been reported:—

Members

Adams, Walter C.
Barlow, John Rigney
Barnett, John Davis, LL.D.
Bertram, Major-Gen. Sir Alexander, K.B.
Brooks, Noel E.
Brower, John L.
Brown, Thomas J.
Burwell, Herbert M.
Ewing, James
Forrest, Benjamin J.
Gamble, F. C.
Hazlewood, Richard A.
Herdt, Louis A., D.Sc.
Hobson, Robert
Johnson, Phelps
Lefebvre, Henri Paul
Maxwell, David F.
McGown, James
Murphy, Martin, D.Sc.
O'Dwyer, J. Seabury
Parsons, W. R. W.
Pickard, Kenneth S.
Pilsworth, W. R.
Ramsey, Col. Colin W. P., C.M.G.
Redmond, Augustine V.
Rinfret, R.
Roy, Georges
Saunders, Col. B. Johnston
Shewen, Edward T. P.
Winckler, G. W.

Associate Members

Ainslie, Chas. M.
Bowes, LeRoy T.
Livingstone, Gilbert T.
Loudon, Andrew C.
Marchand, Art. J. H.
McLerie, Allan Gordon

Students

Bastedo, T. F.
Guscott, A. G.

Total Membership

The membership of The Institute at present totals four thousand seven hundred and thirty-eight, while there are eighty-four applications which have been favourably received, the addition of the names of these applicants to the roll being delayed pending the receipt of their formal acceptance of election. The corresponding numbers for 1925 were 5,119 and 82.

The corporate members now total 3,453, as compared with 3,651 on December 31, 1925.

	Dec. 31, 1926	Dec. 31, 1925
Honorary Members	9	9
Members	1,154	1,162
Associate Members	2,298	2,486
Juniors	460	433
Students	770	984
Affiliates	47	45
	4,738	5,119
Elections—acceptance pending	84	82
	4,822	5,201

Respectfully submitted on behalf of the Council,

Geo. A. Walkem, M.E.I.C., *President.*
R. J. Durley, M.E.I.C., *Secretary.*

Legislation and By-laws Committee

The President and Council,—

The amendments to the By-laws approved by letter ballot in May last were made effective in due course, and have, so far, been found to work satisfactorily.

Questions have been raised, however, regarding certain points not dealt with last year, and have been referred by Council to the committee for consideration and report.

The first of these deals with the provisions in Section 13 of the By-laws regarding a vacancy in the office of president; after consideration, and in order to clear up any apparent ambiguity, it is recommended that in Section 13, paragraph 3, lines 2 and 3, the words: "priority of election to the office of Vice-President," be changed to read, "priority of election as a Vice-President." If changed in this manner, the wording will be similar to that now used in paragraph 4 of the same section regarding a vacancy in the office of vice-president.

Your committee is unable to recommend the insertion of any phrase dealing with the question of the eligibility of a president for re-election, for there has never been any section in the By-laws which would prevent the election of a member as president, or to any other office, for more than one term.

With reference to Section 38, several changes in which became effective during the year, experience has shown that with our present office arrangements it is very difficult, if not practically impossible, to give effect to the existing provision by which no member who is in arrears shall receive the publications of The Institute, as this would involve the maintenance and continued accuracy of two separate mailing lists, one for members in good standing, who would receive all publications, and one for members in arrears, who would receive notifications, etc., but not the publications of The Institute.

In connection with Section 38, the last line of paragraph 1, your committee therefore recommends the deletion of the words, "nor shall he receive the publications of The Institute," and the substitution therefor of the following:—"Council may take action in the case of a member who is in arrears by (*a*) directing that he shall not receive the publications of The Institute, and/or (*b*) removing his name from the register of members."

It is felt that this change, if approved, will give a much more workable arrangement.

The above proposals for amendment have already been submitted to the membership for consideration, and, in accordance with the By-laws, will be open to discussion at the annual meeting.

Your committee has given further consideration during the year to the question of harmonizing branch by-laws, but is not yet prepared with a final report on this matter, in view of the circumstances that branch by-laws cannot be made absolutely uniform, that freedom for the branches is desirable, and that branch by-laws must not conflict with any provisions of the By-laws of The Institute.

Respectfully submitted,

Geo. R. MacLeod, M.E.I.C., *Chairman.*

Nominating Committee—1927

The following nominations to the Nominating Committee for the year 1927 have been made by the various branches, have been noted by Council, and are herewith presented to be announced at the Annual Meeting in accordance with the By-laws.

Halifax Branch	C. H. Wright, M.E.I.C.
Cape Breton Branch	R. R. Moffatt, A.M.E.I.C.
St. John Branch	Alex. Gray, M.E.I.C.
Moncton Branch	G. C. Torrens, A.M.E.I.C.
Saguenay Branch	J. E. A. McConville, A.M.E.I.C.
Quebec Branch	A. Lariviere, A.M.E.I.C.
St. Maurice Valley Branch	A. A. Wickenden, A.M.E.I.C.
Montreal Branch	G. P. Cole, M.E.I.C.
Ottawa Branch	K. M. Cameron, M.E.I.C.
Peterborough Branch	A. L. Killaly, A.M.E.I.C.
Kingston Branch	L. T. Rutledge, M.E.I.C.
Toronto Branch	R. B. Young, M.E.I.C.
Hamilton Branch	H. A. Lumsden, M.E.I.C.
London Branch	F. C. Ball, A.M.E.I.C.
Niagara Peninsula Branch	C. G. Moon, A.M.E.I.C.
Border Cities Branch	M. E. Brian, A.M.E.I.C.
Sault Ste. Marie Branch	J. W. LeB. Ross, M.E.I.C.
Lakehead Branch	F. C. Graham, A.M.E.I.C.
Winnipeg Branch	J. N. Finlayson, M.E.I.C.
Saskatchewan Branch	W. H. Greene, M.E.I.C.
Lethbridge Branch	G. S. Brown, A.M.E.I.C.
Edmonton Branch	A. W. Haddow, A.M.E.I.C.
Calgary Branch	G. P. F. Boese, A.M.E.I.C.
Vancouver Branch	A. K. Robertson, M.E.I.C.
Victoria Branch	R. F. Davy, A.M.E.I.C.

Finance Committee

The President and Council,—

From the attached financial statement, it will be seen that The Institute's expenditure for the year ending December 31st, 1926, has been kept within the budgeted amount, and that instead of the small deficit anticipated in the budget there is actually a book surplus.

Your committee would point out, however, that this apparent surplus of revenue over expenditure does not represent a real reserve of any kind. It is due to two causes:—

First—The special measures taken by Council to recover the arrears of fees have yielded $6,989.73, as compared with the $4,500 anticipated in the budget. This will not recur in future years.

Second—No reduction has been made this year on the Mortgage Account.

The economy in expenditure which has necessarily been observed during the past year is therefore amply justified.

The financial report for last year showed that such economy is needed to keep the expenditure within the revenue, and your committee would again point out that the revenue and expenditure of The Institute are only made to balance by sacrificing services and activities which The Institute should and could give to its members if funds were available.

Respectfully submitted,

J. H. Hunter, M.E.I.C., *Chairman.*

STATEMENT OF ASSETS AND LIABILITIES AS AT DECEMBER 31st, 1926

Assets

Property			$ 89,041.64
Furniture:			
Balance at 1st January, 1926		$ 4,068.73	
Additions during year		1,207.41	
		5,276.14	
Less 10% depreciation		527.61	
			4,748.53
Library:			
Estimated value of books		3,737.81	
Less 10% depreciation		373.78	
		3,364.03	
Stationery			568.33
Gold Medal			45.00
Investments:			
Canada Permanent Mortgage Corporation, 20 shares, par value $10.00 each		215.00	
Montreal Light, Heat & Power Consolidated, 18 shares, no par value		120.50	
$6,000 Montreal Tramways Debentures, $5,000 5%, 1955; $1,000 5%, 1941		5,639.30	
$8,000 Dominion of Canada Victory Loan, 5½%, 1934.	$8,136.71		
Less amount held for Special Funds	2,223.05		
		5,913.66	
			11,888.46
Accounts Receivable:			
Sundry and *Journal* advertising		4,254.24	
Advances to branches		700.00	
		4,954.24	
Less reserved for bad and doubtful debts		599.40	
		4,354.84	
Arrears of fees, estimated			2,500.00
Cash:			
Canadian Bank of Commerce—			
Current account		584.71	
Savings account		848.26	
Petty cash on hand		100.00	
			1,532.97
Unexpired Insurance			254.40
Special Funds, as per schedule attached:			
Investments		9,092.39	
Cash in savings bank		3,458.15	
			12,550.54
			$130,848.74

Liabilities

Mortgage on Property:		
Royal Institute for the Advancement of Learning	$ 10,000.00	
Interest accrued to date	108.33	
		$ 10,108.33
Accounts Payable:		
Sundry	1,834.15	
Reserve for cost of 1926 transactions	2,500.00	
Amounts due to branches	613.43	
		4,947.58
Special Funds:		
As per schedule attached		12,550.54
Life Membership Fees for investment		200.00
Surplus Account:		
Balance at 1st January, 1926	99,921.11	
Add surplus for year	2,821.18	
Proceeds Montreal Light, Heat & Power Pfd. stock redeemed	300.00	
		103,042.29
		$130,848.74

Montreal, 14th January, 1927.

Verified as per our report of this date.

(Signed) Riddell, Stead, Graham & Hutchison, C.A.,
Auditors.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR ENDED DECEMBER 31st, 1926

Revenue

Membership Fees:		
Arrears	$ 6,900.73	
Current	26,536.07	
Advance	405.61	
Entrance	3,660.00	
		$ 37,502.41
Interest:		
On overdue fees	458.38	
On Victory Loan bonds	440.00	
On Montreal Tramways debentures	177.40	
On savings bank account	35.16	
On Montreal Light, Heat & Power Pfd. stock	4.50	
		1,115.44
Dividends:		
Canada Permanent Mortgage Corporation stock	24.00	
Montreal Light, Heat & Power Consolidated stock	45.00	
		69.00
Publications:		
Journal subscriptions	8,124.30	
" advertising	23,391.96	
Year Book advertising	1,015.75	
Transactions, subscriptions	12.00	
		32,544.01
Refund of Expenses of Hall		711.30
Certificates		108.50
Examination Fee		5.00
Badges		38.88
		$72,094.54

Expenditure

Building Expense:		
Interest on Mortgage	$ 650.00	
Taxes	1,489.95	
Water rates	205.70	
Fuel	565.55	
Insurance	114.90	
Light and gas	285.10	
Caretaker—wages and service	1,018.40	
Repairs and expense	468.21	
		$ 4,797.81
Office Expense:		
Salaries, secretary and office staff	13,082.24	
Office supplies and stationery	1,459.44	
Postage and telegrams	1,388.40	
Audit	300.00	
Legal expenses	10.50	
Telephone	221.50	
Messenger and express	108.58	
Miscellaneous	247.09	
		16,817.75
Publications:		
Journal	26,787.62	
Year Book	3,152.37	
Transactions:		
Cost to date	762.02	
Reserve against estimated cost.	2,500.00	
		33,202.01
General Expenses:		
Annual and professional meetings	1,487.00	
Professional Engineers' conference	358.06	
Travelling expenses, secretary	1,836.81	
Branch stationery	212.69	
Students' prizes	125.00	
Library expenses and magazines	1,928.45	
Depreciation on furniture, 10%	527.61	
" " books, 10%	373.78	
Bank exchange and discount	181.47	
Branch charter	20.00	
Gzowski medal	26.25	
		7,077.12
Rebates to Branches		7,091.67
Bad Debts Written Off		287.00
		$69,273.36
Balance—Being excess of revenue over expenditure for year ended 31st December, 1926		2,821.18
		$72,094.54

Montreal, 14th January, 1927.
Verified:
(Signed) Riddell, Stead, Graham & Hutchison, C.A., Auditors.

Schedule No. 1.—Special Funds

Mortgage Fund

Balance as at 1st January 1926	$2,223.05	
Represented by:		
Victory bond, par value $8,000		
Cost price	$8,136.71	
Less amount held for investment account	5,913.66	
		$2,223.05

Leonard Medal

Balance as at 1st January, 1926	$ 531.33	
Add Bond interest	27.50	
Bank interest	1.13	
	$ 559.96	
Less paid for medal	26.25	
		$ 533.71
Represented by:		
Victory Bond, 5½%, 1927	$ 500.00	
Balance in bank	33.71	
		$ 533.71

Plummer Medal

Balance as at 1st January, 1926	$ 558.00	
Add Bond interest	27.50	
Bank interest	1.98	
	$ 587.48	
Less paid for medal	26.25	
		$ 561.23
Represented by:		
Victory Bond, 1934, 5½%	$ 500.00	
Balance in bank	61.23	
		$ 561.23

Prize Fund

Balance as at 1st January, 1926	$ 543.48	
Add Bank interest	16.37	
		$ 559.85
Represented by:		
Balance in bank		$ 559.85

Fund for Relief of Members' Families

Balance as at 1st January, 1926	$1,518.38	
Add Bond interest	77.00	
Bank interest	4.21	
Donation	15.00	
		$1,614.59
Represented by:		
$1,400 Victory Bond, 5½%, 1934	$1,400,00	
Balance in bank	214.59	
		$1,614.59

Past Presidents' Fund

Balance as at 1st January, 1926	$2,830.60	
Add Bond interest	125.00	
Bank interest	12.14	
		$2,967.74
Represented by:		
$2,500 Dominion of Canada C.N.R. 5%, 1954	$2,489.55	
Balance in bank	478.19	
		$2,967.74

War Memorial Fund

Balance as at 1st January, 1926	$3,126.49	
Add Bond interest	100.00	
Bank interest	51.38	
Subscriptions for year	812.50	
		$4,090.37
Represented by:		
$2,000 C.P.R. Coll. Trust, 5%, 1934 bonds	$1,979.79	
Balance in bank	2,110.58	
		$4,090.37

Papers Committee

The President and Council,—

The Papers Committee, according to the By-laws, consists of a chairman and, as far as possible, a representative from each branch. It has been customary in recent years to name the branch secretaries, ex-officio, members of this committee. This is not an entirely satisfactory arrangement for two reasons; one being that the committee is so unwieldy that it is impossible to get representative action, and, second, that the branch secretary is frequently not the branch officer who is best acquainted with the local papers situation; in fact, it is found that many branch secretaries do not act as members of this committee, but refer correspondence to some other official.

An innovation was made this year by appointing an eastern and a western vice-chairman of the committee. W. J. Johnston, A.M.E.I.C., of St. John, acted for the Maritimes, while E. A. Wheatley, A.M.E.I.C., of Vancouver, represented the western branches. It has not been possible to prepare this report as a result of collaboration between the members of the committee, but simply of the chairman and vice-chairman.

The principal work performed by the committee in the past year has been the aiding of branches in obtaining speakers from outside their own immediate territory, and while it is not possible to give a list of concrete cases where this has been done, owing to the difficulty of segregating cases where the committee has only been of secondary use, nevertheless the work of the committee has borne fruit to the satisfaction of many branches. It is our recommendation that the work of the committee be continued along these lines.

We also respectfully suggest that Council give consideration to the desirability of either changing the By-law appointing the committee, so as to provide that the committee consists of about three or four members widely separated, or, if this is not found desirable, to have each branch appoint its special representative.

Mr. Johnston's view differs slightly from this. He is of opinion that a representative from each branch should be on the Papers Committee, its numbers therefore remaining as at present, thus ensuring that all meritorious papers originating in the different branches will be forwarded to Headquarters; in addition, since twenty-five members scattered across Canada cannot easily act together for effective work, there should be a working sub-committee of from three to five members chosen from the committee.

We also recommend that a definite appropriation be made by Council and placed at the disposal of the committee in order that some fund may be available from which may be paid the travelling expenses, in whole or in part, of a speaker who may be willing to devote his time to the presentation of a paper at a number of branches. We presume it is not necessary to dwell upon the difficulty smaller and outlying branches have in getting sufficient speakers. In many cases it is only possible to maintain interest in the branch if some outside speakers are obtained, and it is only by so doing that members of such branches can be expected to sustain their interest in The Institute.

The chairman of your committee has also collaborated from time to time with the general secretary and with the chairman of the Quebec branch with reference to papers for the annual meeting at Quebec.

Respectfully submitted,

J. L. Busfield, M.E.I.C., *Chairman.*

Publication Committee

The President and Council,—

The Publication Committee was not completely formed until after notification on May 25th, 1926, that Council had reached the decision to resume the publication of Transactions. Your committee had a number of meetings during the summer and fall months, and carefully studied all the papers which had been presented to The Institute or its branches during the years 1923, 1924 and 1925. After due consideration, the following twelve papers were approved for publication. In some cases, advice from members outside the committee was obtained as to the merit of papers.

Title	Author
The Cost of Hydro-Electric Power. Discussion	C. V. Christie, M.E.I.C.
An Economic Examination of the Hudson Bay Project	W. Nelson Smith, M.E.I.C.
The Hudson Bay Railway	J. L. Busfield, M.E.I.C.
Inductive Co-ordination as a Practical Problem	J. L. Clarke, A.M.E.I.C.
Steel Rails	C. B. Bronson.
Consideration of Rainfall and Run-off in Connection with Sewar Design in the Montreal District	J. G. Caron, A.M.E.I.C.
British Columbia Dams	E. Davis, M.E.I.C., and E. G. Marriott, A.M.E.I.C.
Cost of Electric Power	P. T. Davies, M.E.I.C.
The Municipal Underground Conduit System of Montreal	G. E. Templeman, A.M.E.I.C.
Hydraulic Regulating Gates	F. Newell, M.E.I.C.
The New Esquimalt Drydock	J. P. Forde, M.E.I.C.
Report on the Strength of Steel I-Beams Haunched with Concrete	Peter Gillespie, M.E.I.C., H. M. MacKay, M.E.I.C., and C. Leluau, M.E.I.C.

In view of the necessity of producing legible drawings of uniform standard, the committee requested authority to spend up to $1,000 for the preparation of suitable drawings. Upon the granting by Council of the necessary appropriation, the work was carried out under the supervision of the committee at a cost of about one-half the aforesaid amount.

Apart from the selections of papers for the Transactions, there has been no work before the committee.

Respectfully submitted,

J. L. Busfield, M.E.I.C., *Chairman.*

Library and House Committee

The President and Council,—

Substantial progress has been made during the past year in cataloguing and indexing the library, the present condition being as follows:—

Technical Books and Pamphlets:—The work of cataloguing, marking and shelving these is now almost up to date.

U. S. Government Material:—This has been catalogued and much of it has been marked and shelved.

British Patent Specifications:—These have been sorted and listed.

Canadian and U. S. Patent Specifications:—These have not yet been listed nor catalogued.

Transactions and Other Society Publications:—These have been shelved, but not yet catalogued.

Periodicals:—Our collection of technical periodicals is quite a representative and valuable one, and these are shelved and available for consultation, but are not yet catalogued.

New Books:—With the limited resources available, it is not possible to obtain for our library a very large or representative collection of new books.

Reference Work

During the year the reference and information service has been largely taken advantage of by members; information having been sent by mail as to source of information desired and, in many cases, photostat and other copies having been obtained for enquirers. The number of enquiries dealt with during 1926 was 185.

The important thing for a library such as that of the Engineering Institute of Canada is, however, to possess easily accessible information as to the books available on any particular subject, and, if not in our own library, where they can be found. We are, therefore, now adding cards to our catalogue that list new books which are not in our library, but are of importance in connection with our information service. These entries are on coloured cards, distinguishing them from the cards representing books in our possession. This list will be of considerable bibliographical aid.

The committee feels that, as far as financial resources permit, every effort should be made to render the library resources and information service more readily available for the membership at large. For this purpose, efforts are being made to make members familiar with the conditions under which they can obtain books on loan, and information and data on various topics.

The work in connection with the library has been greatly facilitated by the new steel shelving installed during the year, which has afforded much needed space for shelving books, transactions, etc., for which there previously was no room.

The expenditure on the library during the year amounted to $1,928.45, of which $684.95 represents expenditure on periodicals, binding and new books and the balance the cost of cataloguing work.

The thanks of The Institute are due to a number of individuals and organizations for the presentation of books and reports. These have been listed each month in The Engineering Journal on pages 174, 261, 312, 246, 421, 446, 478, 525.

The following is the list of books added to the library during the year:—

Economics of Highway Engineering, by H. T. Tudsbery.
Galvanizing, by Heinz Bablik.
Workshop Operations and Layouts for Economic Engineering Production, by Philip Gates.
Metal-Plate Work, by C. T. Millis.
Presented by E. & F. N. Spon & Company, London.
Metallurgy and its Influence on Modern Progress, by R. A. Hadfield.
Stainless Iron and Steel, by J. H. G. Monypenny.
Coal & Ash Handling Plant, by J. D. Troup.
Presented by Chapman & Hall.
Storage Batteries Simplified, by V. W. Page.
Standard Electrical Dictionary, by T. O'Conor Sloane.
Presented by Norman W. Henley Publishing Company.
A Century of Progress—History of Delaware and Hudson Company, 1823-1923.
Presented by L. F. Loree, President of the Delaware and Hudson Company.
Canadian Trade Index, 1926.
Presented by the Canadian Manufacturers' Association.
Concrete—Plain and Reinforced, vol. 1. By Taylor, Thompson and Smulski.
An Elementary Treatise on Statically Indeterminate Stresses, by J. I. Parcel and G. A. Maney.
Elements of Heat Power Engineering, part 1. By W. N. Barnard, F. O. Ellenwood, and G. F. Hirshfield.
Presented by John Wiley & Sons, Inc.
Superpower, its Genesis and Future, by W. S. Murray.
Bacteriology, by Stanley Thomas.
Fuels and Their Combustion, by R. T. Haslam and R. P. Russell.
Corrosion—Causes and Prevention, by F. N. Speller, M.E.I.C.
Concrete Designer's Manuel, by G. A. Hool and C. S. Whitney.
Presented by McGraw-Hill Book Company, Inc.
Draft and Capacity of Chimneys, by J. G. Mingle.
Elementary Steam Engineering, by E. V. Lallier.
Presented by D. Van Nostrand Company.
Depreciation in Public Utilities, by Delos F. Wilcox.
Presented by the National Municipal League.
Les Moteurs à Explosion, by E. Marcotte.
Les Moteurs à Combustion, by E. Marcotte.
La Transformation de l'énergie électrique—I, Transformateurs, by René Cartonet and Pierre Dumartin.
Presented by Librairie Armand Colin, Paris.
Combustibles Inférieurs et de Remplacement, by P. Appell
Presented by Gauthier-Villars, Paris.
The Ethics of Business, by E. Heermance.
Presented by Harper & Bros.
Materials and their Application to Engineering Design, by Professor E. A. Allcut, M.E.I.C., and E. Miller.
Engineering Inspection, by Professor E. A. Allcut, M.E.I.C., and C. J. King.
Presented by Professor E. A. Allcut, M.E.I.C.
Mathematical and Physical Papers, 1903-13, by B. O. Pierce.
Presented by the Harvard University Press.
Transmission Line Theory and Some Related Topics, by W. S. Franklin and F. E. Terman.
Presented by Franklin & Charles.
Thirteenth Edition New Volumes Encyclopedia Britannica.
Purchased from the Encyclopedia Britannica, Inc.
Northcliffe Collection.
Presented by Archives of Canada.
British Standard Glossary of Terms used in Electrical Engineering.
Presented by the British Engineering Standards Association.
Gazetteer of Canada, 1926.
Purchased from the Canadian Gazetteer Publishing Company, Toronto.

As regards the Headquarters building, the expenditure on repairs and maintenance during the year amounted to $468.21, including repairs to the outside steps in the front and sundry repairs to furniture.

Respectfully submitted,

O. O. Lefebvre, M.E.I.C., *Chairman.*

Board of Examiners and Education

The President and Council,—

The principal task of the Board during the year was a thorough revision of the syllabus for examinations. Upon the recommendation of the Board, amendments to Sections 8, 9 and 10 of the By-laws were drafted and submitted to the membership of The Institute providing that examinations under Schedule *A* shall be passed by candidates for admission as Student members who do not present satisfactory evidence as to their educational qualifications; and that, similarly, examinations under Schedule *B* shall be passed by candidates for the grade of Junior whose qualifications are not otherwise established. These amendments were adopted, and the syllabus was re-arranged accordingly.

Schedules *A* and *B* were revised to meet present-day conditions more satisfactorily, and Schedule *C* was completely revised and extended so as to provide, as far as practicable, for candidates in such branches as chemical and metallurgical engineering and electrical communications. Further, sub-division of Schedule *C* was also made in recognition of the growing diversity and tendency towards specialization in engineering practice.

The revised syllabus, together with typical examination papers, was prepared for publication, a step which, it is hoped, will prove helpful to candidates for examination.

Respectfully submitted,

H. M. MacKay, M.E.I.C., *Chairman.*

Gzowski Medal Committee

The President and Council,—

The undersigned, your committee appointed to canvass papers presented to The Institute during the season of 1925-1926, with a view to recommending the award of the Gzowski Medal to the most meritorious, respectfully reports as follows:—

Your committee has carefully canvassed the papers referred to, with the result that it recommends that the Gzowski Medal for this year be awarded to—

Lesslie Rielle Thomson, M.E.I.C., for his paper "The Fuel Problem in Canada," presented at the annual general meeting of The Institute in Toronto, January 29th, 1926, and published in The Engineering Journal for February 1926, pages 64-72.

Mr. Thomson's paper deals with a subject vital to Canada and its people. The committee believes that he has faced the facts without prejudice, and that the conclusions he has drawn from them are sound.

Respectfully submitted,

R. DeL. French, M.E.I.C., *Chairman.*
Frederick B. Brown, M.E.I.C.
H. V. Haight, M.E.I.C.
A. W. Campbell, M.E.I.C.
Peter Gillespie, M.E.I.C.

Leonard Medal Committee

The President and Council,—

After a study of the papers eligible for this prize, your committee has come to the conclusion that there is no paper of sufficient merit to be awarded the prize amongst those published between June 1925 and May 1926.

The chief reason for arriving at this decision is that none of the papers considered appear to contain original ideas, the best of them being only excellent compilations.

Respectfully submitted,

J. Colin Kemp, A.M.E.I.C., *Chairman.*

Plummer Medal Committee

The President and Council,—

The committee recommends that the Plummer Medal be awarded to Dean C. J. Mackenzie, M.E.I.C., and Professor T. Thorvaldson for their paper on "Differentiation of the Action of Acids, Alkali Waters and Frost on Normal Portland Cement Concrete," published in the Journal of The Institute, February 1926, page 79.

The committee again recommends that, if the consent of the donor can be obtained, the Plummer Medal shall be awarded in future for papers that have been presented either to The Engineering Institute of Canada or to The Canadian Institute of Mining and Metallurgy, as in the case of the Leonard Medal.

Respectfully submitted,

Alfred Stansfield, M.E.I.C., *Chairman.*

Students' Prize Committee

The President and Council,—

I have pleasure in recommending on behalf of this committee the following awards of the Students' Prizes of The Institute for 1925-26:—

For Chemical Engineering—W. T. D. Ross, S.E.I.C.,—"Salt Mining in Nova Scotia—A New Industry."

For Mechanical Engineering—R. G. Beck, S.E.I.C.,—"How the Fabrication of the Miehle Printing Press is Controlled."

For Electrical Engineering—B. C. Hicks, S.E.I.C.,—"The Ground Selector."

For Civil Engineering—H. A. Gauvin, S.E.I.C.,—"Scientific Principles Applied to Dwelling House Construction."

Essays submitted have been read by all members of the committee. Lack of time unfortunately prevents the committee from submitting a formal report signed by all its members, as it has already done with respect to the Gzowski Medal. The recommendations made above, however, conform to those made by individual members of the committee, in letters addressed to its chairman.

Respectfully submitted,

R. DeL. French, M.E.I.C., *Chairman.*

Committee on Engineering Education

The President and Council,—

This committee, consisting of T. H. Hogg, M.E.I.C., H. J. Lamb, M.E.I.C., J. D. Craig, M.E.I.C., C. C. Kirby, M.E.I.C., S. G. Porter, M.E.I.C., and the writer as chairman, was reappointed in February 1926, and the writer immediately communicated with the various members of the committee, with the Society for the Promotion of Engineering Education, with several of the universities and with certain individuals in connection with the work. The problem confronting the committee is a very large one, requiring a great deal of careful study which we find very difficult to arrange. There is so much work being done on this subject that it would seem unwise for your committee to attempt to make an independent study of the whole question, and it is our conclusion that better results would probably be obtained by offering our co-operation to the Society for the Promotion of Engineering Education for help in solving any problem upon which they might ask our assistance, particularly with regard to Canadian conditions.

Sets of progress reports were obtained from the Society for the Promotion of Engineering Education and distributed to the members of your committee for study, and they were also referred to the Journal of Engineering Education and other similar publications. Reports of committees have been received from McGill University, Queen's University, Leland Stanford University, from the Association of Professional Engineers of British Columbia and others, and a collection has been commenced of articles, documents and bibliography of the subject. The committee has had considerable correspondence amongst its members, but it has not yet been possible to formulate any definite recommendations or conclusions.

Some of the questions which seem to the committee to be of importance are as follows:—

(1) What is the present consensus of opinion as to the relation of the universities to the engineering profession?

(2) Are the universities attempting to do work which should be done by trade and technical schools?

(3) Is there a definite demand or field for apprenticeship courses for the engineering profession, either to supplement or take the place of a university training?

(4) Are the universities preparing men on the average to take subordinate industrial positions or are they attempting to train thinkers and leaders?

(5) Should engineering education be a training for the profession of engineering in a general

sense on broad fundamental lines, or should the attempt be made for more highly specialized training for specific and narrower fields of work?

(6) Should engineering education be considered as a course of culture, as a foundation for a future career in any walk of life, possibly taking the place of an arts course to some extent?

(7) Are the present standards of admission to the engineering courses too low and is the ordinary course of four years too short?

(8) Does the apparently large percentage of students failing to graduate, or being unsuccessful in engineering after graduation, indicate a deficiency in the methods or personnel of the teaching organization, or does the fault lie with the student in choosing the wrong career at an immature age with insufficient knowledge and preliminary preparation?

(9) What would be the effect of training a much smaller number of students annually with higher entrance requirements and possibly longer courses in much smaller classes?

(10) Should the teachers in high schools and preparatory schools make more direct efforts to find out the personal characteristics and qualifications of pupils and attempt to guide them as to their future life work, giving special preparation to those who seem to be fitted for university training in any one of the professional walks of life?

The above are some of the questions in one form or another which have been brought to the attention of members of your committee, and serve to indicate the magnitude of the task if we attempt to solve the various problems, especially as many of these questions and others are being considered by the Society for the Promotion of Engineering Education and by the various universities.

We, therefore, recommend that The Institute write to the Society for the Promotion of Engineering Education offering to co-operate actively with it in the field of engineering education, and saying that it will continue to appoint a committee which will hold itself in readiness to consider any points brought to its attention, particularly with regard to Canada, but not undertaking a complete or independent study of the whole matter.

Respectfully submitted,

Frederick B. Brown, M.E.I.C., *Chairman.*

Committee on International Co-operation

The President and Council,—

The outstanding feature of International Co-operation for the year 1926 was the work connected with the short visit to Niagara Falls, Toronto, Ottawa and Montreal, at the end of April and beginning of May, of 125 ladies and gentlemen, most of them from Europe, who had come to this continent to attend the Plenary Meeting of the International Electrotechnical Commission in New York from April 12th to 22nd.

The New York meeting was arranged for primarily by the members of the American Institute of Electrical Engineers, who have been actively connected with the International Electrotechnical Commission since its inception at the Louisiana Purchase Exposition, (the "World's Fair"), at St. Louis in 1904. American committees were formed embracing in their personnel representatives from not only all branches of engineering but from all branches of human activities in which engineering, particularly electrical engineering, plays a prominent part.

The "Americans" invited the Canadian National Committee of the International Electrotechnical Commission to share the honours and to act as joint hosts in welcoming the visitors to the American continent. The Canadian Committee tentatively accepted the proposal and sought the assistance of their engineering confreres, as well as all others in the "electrical business,"—light, power, communication and manufacturing,—in the district which was to be visited. The immediate response and the whole-hearted co-operation of the officers of the E.I.C. at Headquarters and of the officials and members of the branches in the Niagara district, at Hamilton, Toronto, Ottawa and Montreal made it unnecessary even to call a meeting of our International Co-operation Committee. The generous contributions of the power and communication companies and the manufacturers eliminated what otherwise might have become a financial burden on local committees; and through the kindness of Sir Henry Thornton, president and chairman of the Canadian National Railways, and his prompt appreciation of the advertising value to Canada of such a visit, the visitors' special train, supplied with the compliments of the American Committee, was gratuitously hauled from Windsor through Ontario and Quebec to the eastern international boundary,—on its way to Boston from Montreal.

Material assistance also came from members of the Ottawa Rotary Club, who, together with our Ottawa branch members, supplied the automobiles which took the visitors to the hydro-electric developments of the Gatineau Power Company. Mr. Guido Semenza, the International President of the I.E.C., is a member of the Rotary Club of Milan, Italy, and on that account the Ottawa Rotarians were glad to do honour to him and his party.

The manner in which all members of the Engineering Institute of Canada,—without regard to their specialties in chemical, mechanical, mining or any other "civil" pursuits,—took part in the work of entertaining the visitors provided a great object lesson which once again shows the wisdom of having in a country like Canada an Engineering Institute which embraces every branch of the profession.

Respectfully submitted,

John Murphy, M.E.I.C., *Chairman.*

Canadian National Committee of the International Electrotechnical Commission

The President and Council,—

The committee have had a very busy year in connection with the New York Conference last April, the first meeting of the I.E.C. to be held on this side of the Atlantic. The proceedings of that meeting and the ensuing Canadian tour of the visiting European delegates have already been reported.

The committee is now busily preparing for next year's conference, to be held in Italy during September, for which the Canadian National Committee, at the resquest of the Central Office, has nominated R. L. Hearn, M.E.I.C., to prepare the Paper on "The Necessity for an International Rating of Hydraulic Prime Movers for Electric Power Generation."

Work is also actively proceeding on the preparation of an International Technical Vocabulary, and considerable progress has to be reported in the matter of specifications for hydraulic and steam prime movers for electrical generators.

The work of the committee is increasing so rapidly that the regular quarterly meetings are insufficient to cope with it. During the year W. P. Dobson, M.E.I.C., joined the committee as representative of the Hydro-Electric Power Commission of Ontario, and at the request of the committee the Canadian Westinghouse Company have nominated Mr. C. A. Price as their representative on the committee.

At their October meeting at Ottawa the committee elected as officers for 1927, Mr. J. Kynoch as president, J. Murphy, M.E.I.C., as vice-president, and re-elected H. A. Dupré, M.E.I.C., as secretary-treasurer.

The personnel of the committee is now as follows:—

Howard T. Barnes, M.E.I.C.	O. Higman, M.E.I.C.
J. B. Challies, M.E.I.C.	A. Frigon, A.M.E.I.C.
W. P. Dobson, M.E.I.C.	G. Gordon Gale, M.E.I.C.
H. A. Dupré, M.E.I.C.	J. Kynoch.
R. J. Durley, M.E.I.C.	A. B. Lambe, A.M.E.I.C.
John Murphy, M.E.I.C.	A. Larivière, A.M.E.I.C.

L. W. Gill, M.E.I.C.

Respectfully submitted,

Howard T. Barnes, M.E.I.C., *Chairman.*

Code of Ethics Committee

The President and Council,—

The Committee on Code of Ethics begs to report that, having considered the matter, it does not wish to recommend any change at the present time.

Respectfully submitted,

Frederick B. Brown, M.E.I.C.
F. P. Shearwood, M.E.I.C.

Honour Roll and War Trophies Committee

The President and Council,—

It is gratifying to report that during the year 1926 the amount necessary for the completion of the work has been collected, and the sum of $4,090.37, (in Canadian Bank of Commerce $2,110.58, in Bonds $1,979.79), now stands to the credit of the committee.

Progress has been made in the important work of checking the nominal lists for the Memorial and the Record in bronze, members having been notified twice in the Journal, (September and October issues), and a circular regarding the matter having also been mailed to all members. Replies to these communications are still coming in. The corrected lists have still to be forwarded to National Defence Headquarters, Ottawa, for final confirmation.

Respectfully submitted,

Charles J. Armstrong, M.E.I.C., *Chairman.*

Report of the E.I.C. Members of the Main Committee of the Canadian Engineering Standards Association

The President and Council,—

The Institute nominees on the Main Committee of the C.E.S.A. are now as follows:—

F. B. Brown, M.E.I.C.,	(retires March 1927).
Prof. C. M. McKergow, M.E.I.C.,	(" " 1928).
Dean C. J. Mackenzie, M.E.I.C.,	(" " 1929).

Professor McKergow was nominated by the Council of the E.I.C. to succeed the late Sir Alexander Bertram, M.E.I.C.

The total number of working committees and panels now stands at 67 and the membership of the Association at 463.

During part of 1925, and up to April 1926, Professor W. F. McKnight, A.M.E.I.C., of the Nova Scotia Technical College, Halifax, was acting secretary, and on April 19th, B. Stuart McKenzie, M.E.I.C., was appointed secretary.

The Association is at present operating as the Associate Committee on Engineering Standards of the National Research Council, by whom it has been granted funds for operating expenses. The granting of these funds is contingent on the securing of financial support from various industries.

The year has been devoted to promoting interest in the Association's work, and in reviving the work of committees. Special work has also been done with regard to publicity and arrangements have been made for issuing a Year Book which will be used in an organized campaign for financial support.

Publications Issued in 1926

A19—1926. Standard Classification of Items of Highway Expenditure. This covers the classification of highway accounts in some detail, with the object of securing uniform practice throughout Canada.

A complete list of the publications issued by the Association to date is as follows:—

C.E.S.A. Publications

A1—1922 Standard Specification for Steel Railway Bridges.
A1a—1922 Material Specifications, Steel Railway Bridges (reprint).
C2—1920 Standard Requirements for Distribution Type Transformers.
C3—1924 Standard Specification for Galvanized Telegraph and Telephone Wire.
B4—1921 Standard Specification for Wire Rope for Mining, Dredging and Steam Shovel Purposes.
A5—1922 Standard Specification for Portland Cement.
A6—1922 Standard Specification for Steel Highway Bridges.
D7—1922 Standard Specification for Flexible Steel Wire Rope and Flexible Strand for Aircraft Purposes.
G8—1923 Standard General Specification for Commercial Bar Steels.
A9—1923 Standard Specifications for Reinforcing Materials for Concrete.
C10—1923 Standard Specification for Tungsten Incandescent Lamps.
D11—1924 Interim Report on the Manufacture, Testing and Use of Gasoline.
B12—1924 Standard General Specification for Galvanized Steel Wire Strand.
E13—1924 Standard Specification for Railway Wire-fencing and Gates.
C14—1924 Standard Specification for Reinforced Concrete Poles.
C15—1924 Standard Specification for Eastern Cedar Poles.
A16—1924 Standard Specification for Steel Structures for Buildings.
C17—1925 Standard Requirements for A.C. Watthour Meters.
B18—1925 Standard Specification for Stove Bolts.
A19—1926 Standard Classification of Items of Highway Expenditure.

Work in Progress

Civil Engineering and Construction

Moveable Bridges. Final revised draft is now receiving comments from the joint Bridge Committees.

Concrete and Reinforced Concrete. The majority of the reports from panels have been received from chairmen, and a definite report is promised early next year.

Reinforcing Materials for Concrete. The approval of the revised list of bars has been received and the list will be printed as an appendix to existing specification No. A9—1923.

Road Materials and Construction. Final drafts have been prepared covering block pavements, broken stone roads and sand clay roads. A final draft specification for asphalt pavement has now been criticized by the panel and one for concrete roads is out for comment by members of that panel. Nothing further has been done in regard to earth roads or foundation and sub-grade preparation. A specification for gravel roads is in the hands of the chairman of the panel. Specifications for road structures and for definitions of road and highway terms are now being re-drafted for submission to the respective panels.

Steel Highway and Steel Railway Bridges. A meeting of the joint committees was held in Montreal on September 22nd, and revisions were considered to the existing specifications. Revisions covering silicon steel, increased unit stresses in highway bridges, and bridge paint were considered, and some of these have been tabulated and submitted to the committees for comment. Specification for silicon steel will be added, and allowable unit stress in highway bridges has been increased from 16,000 to 18,000 pounds.

Steel Structures for Buildings. The question of raising allowable unit stresses is becoming more active, and this will be considered at an early meeting of the committee.

MECHANICAL ENGINEERING

Machine Screws. The committee held a meeting in Toronto on September 8th last, and appointed a panel to prepare data sheets showing suggested range of sizes, threads and tolerances. This panel will report shortly, and it is hoped to eliminate a great many types of machine screws and be able to supply the demand from a simplified list.

Sheet Metal Gauges. A committee has been formed and held a meeting in Toronto on September 8th. A panel was appointed to prepare recommendations, and this panel met in Toronto on December 10th, at which meeting a resolution was presented covering the adoption of a Canadian standard gauge. This resolution will be circulated among the members of the committee for final approval.

Cast Iron Pipe. A preliminary draft was prepared by the chairman and the secretary, and a revised draft has been submitted to the members of the committee for comments, which are now being received.

Corrugated Iron Pipe. At the suggestion of the chief engineer of the Nova Scotia Highway Board, arrangements have been made with the various provinces to collect reports as to the behaviour of corrugated iron pipe in service. As a result of these reports, it may be possible to prepare some sort of specification.

ELECTRICAL ENGINEERING

Western Cedar Poles. The final draft specification is being held until a report from a committee of the American Engineering Standards Committee is available.

Rating and Testing of Electrical Machinery. A report has been received from Panel *A* covering the rating and testing of large power rotating machinery. Panel *B*, covering rotating machinery under ordinary conditions, is active and a report is promised shortly. Panel *C* on transformers has discussed the question and a report is now being prepared.

Canadian Electrical Code. The first draft of Rules and Regulations was considered at a meeting of the committee in Ottawa on May 10th and 11th last, and considerable revision was made. Panels on grounding and radio, and a reference panel, were appointed and reports from these are expected before the end of the year. The committee has been greatly handicapped by the death of Mr. A. A. Dion, the efficient chairman of the committee.

Transformers. Meetings of the committee have been held in Montreal on September 24th and in Toronto on December 8th. Revisions to Specification C2—1920, for distribution type transformers, have been approved, and a report on the rating and testing of transformers is in preparation. The preparation of a specification for power transformers will be considered at the proposed meeting in Ottawa in January next.

Colour Code for Control Cable. A suggestion was received for the consideration of a colour code for control cable, and a committee has been formed to consider this question, also general specifications for control cable. The committee held its first meeting in Toronto on December 7th, at which a draft specification was approved and this will now be circulated among the members of the committee for comment.

AUTOMOTIVE WORK

Traffic Signals for Highways. A final draft specification was sent out to the committee for comment, and a meeting was held on December 17th at which the revised draft was approved. This will now be sent to the Sectional Committee and Main Committee for final approval.

FERROUS METALS

Heavy Steel Castings. Suggestions for a specification made by the chairman of the committee were considered at a meeting in Montreal on August 6th, at which meeting a panel was appointed to prepare a draft specification. This panel had a meeting in Montreal on November 22nd, and the proposed specification is well under way. It is proposed to include smaller castings, so that specification will be as general as possible.

Sampling for Check Analysis. A committee has been organized, and suggestions for scope of the specification are being received from members of the committee.

Forging Quality of Bar and Billet Steel. A committee has been organized, and is now considering the A.S.T.M. specification as a preliminary.

CO-OPERATION

Co-operation with other standardizing bodies has been continued, and representatives on various committees of the American Engineering Standards Committee are still acting, a representative for the Committee of Manhole Frames and Covers being appointed during the year.

There has been the usual exchange of information and specifications with other national standardizing bodies, and the Association has co-operated particularly with the British Engineering Standards Association in commenting on tentative specifications which have been issued.

Respectfully submitted,

C. J. MACKENZIE, M.E.I.C.

Committee on the Deterioration of Concrete in Alkali Soils

The President and Council,—

Your committee begs to report that during the past year work has progressed well on the Chemical Research. One paper, entitled "Action of Sodium and Magnesium Sulphates on Portland Cement," by G. R. Shelton, has been published in the Journal of Industrial and Engineering Chemistry *18*, 854, 1926. Two other papers have been prepared and are now ready for publication, as follows: (1) "The Expansion of Portland Cement Mortar Bars During Disintegration in Sulphate Solutions," by T. Thorvaldson, R. K. Larmour and V. A. Vigfusson, and (2) "The Action of Sulphate Solutions on High Alumina Cements," by T. Thorvaldson and D. Wolochow.

Further papers on other phases of the subject are in course of publication, and it is expected that they will be published during the coming year.

Plans were made to hold a detailed inspection of the field blocks this fall and to issue a report on the results of five years of exposure, but the unusually rainy weather experienced in the west made an inspection at that time impossible, but we hope to make such an inspection and report some time during the coming summer or fall.

Financial

The following summary of expenditures and receipts as to December 1st, 1926, is submitted. A detailed statement of expenditures from December 1st, 1925, to December 1st, 1926, is being sent to the financial supporters of the research.

Total Expenditures to December 1st, 1926

General:		
Committee meetings, travelling expenses	$1,836.56	
Miscellaneous telegrams, office expenses	353.85	
		$2,190.41
Physical Tests:		
Travelling allowances and expenses	$1,123.66	
Material, labour and equipment	1,745.67	
Freight and cartage	353.09	
		$3,222.42
Chemical Research:		
Travelling expenses	$ 340.81	
Salaries	32,659.85	
Materials	6,926.59	
		$39,927.25
		$45,340.08

Expenditures During Year December 1st, 1925-December 1st, 1926

Physical Tests:		
Labour at Winnipeg Test Pits		$ 17.09
Chemical Research:		
Salaries to laboratory assistants	$3,692.11	
Materials	1,469.59	
		$5,161.70
		$5,178.79

Total Receipts to December 1st, 1926

	1921	1922	1923	1924	1925	1926	Total
Research Council	$5,000	$5,000	$5,000	....	....	$5,000	$20,000,00
Can. Cement Co.	3,000	3,000	3,000	....	$2,997	....	11,997.00
Saskatchewan	3,000	3,000	3,000	....	....	....	9,000.00
Alberta	1,000	1,000	....	....	....	....	2,000.00
C. P. R.	1,000	1,000	1,000	....	....	....	3,000.00
City of Winnipeg	200	200	300	....	....	....	700.00
Interest on bank account			139.41	422.14	190.65	193.71	945.91

Total receipts	$47,642.91
Expenditures	45,340.08
Balance in bank December 1st, 1926	$2,302.83

From the above statement, it will be seen that we have received during the past year another $5,000 from the Research Council, (this money was received in December 1925), and that our expenses during the same period have been largely in connection with salaries to laboratory assistants.

Respectfully submitted,

C. J. Mackenzie, M.E.I.C., *Chairman.*

Committee on Young Graduates

During 1925 the Council appointed a Committee on Young Graduates, consisting of R. A. Ross, M.E.I.C., H. G. Acres, M.E.I.C., G. R. Marston, A.M.E.I.C., R. E. Smyth, Jr.E.I.C., C. E. MacDonald and H. E. T. Haultain, M.E.I.C. The chairman of this committee, Professor Haultain, has submitted to Council a fairly lengthy confidential report in which he points out that very little is being done by any organization in Canada for young technical graduates. He urges that the Engineering Institute of Canada throughout its branches should stir up this matter for discussion. He points out that the technically trained man is needed in all branches of commercial activity, but that employers as a rule are not "sold" on the product of the universities. After pointing out that the young engineering graduate is the nation's finest partially processed product, he asks: "Is it not a great national need that employers be properly 'sold' on this product?"

Branch Reports

Border Cities Branch

The President and Council,—

The Executive Committee of this branch begs to submit the following annual report for the year ending December 31st, 1926.

During the year some very interesting addresses were given. These, however, failed to bring the members' attendance to such numbers as might be expected, the number varying from 13 to 60, with an average attendance to date of 31, or a total of 217 for the year. There are but 77 resident members living on this side of the river, so that this attendance is, after all, not so bad. Thirty-four members live in Detroit and 19 are non-resident. The total now on our roster is 130.

Meetings

The Executive met regularly throughout the year for the consideration of matters before it, and the following general meetings of the branch were held:

Jan. 15.—Address by Mr. S. F. J. Fryer, past president of the Ontario Architects' Association. Present, 14 members and 12 guests.

Feb. 12.—J. Clarke Keith, A.M.E.I.C., chief engineer of the Essex Border Utilities Commission, spoke on, "**The Border Cities Water Supply.**" Present, 27 members and 1 guest.

Mar. 12.—Mr. A. McLay, of the Detroit Edison Company, spoke on "**Mechanical Refrigeration.**" Present, 26 members and 4 guests.

Apr. 27.—On this evening the Border Cities Branch members were the guests of Detroit Section of the American Society of Mechanical Engineers at the Detroit Engineering Society's headquarters in Detroit. Mr. William J. Kelley, consulting engineer for the National Electric Light Association and American member of the Saint Lawrence Deep Waterways Association, spoke on "**Lake Regulation and the Development of the Saint Lawrence River.**" There were present 25 members of the Border Cities Branch.

May 27.—The Honourable Charles McCrae, minister of mines for the province of Ontario, spoke on "**Mining Development in Northern Ontario.**" Present, 22 members and 13 guests.

Oct. 8.—M. E. Brian, A.M.E.I.C., city engineer of Windsor, spoke on "**The Functioning of the City Board of Public Works.**" Present, 13 members.

Nov. 12.—Mr. R. D. Malm, of the Lincoln Electric Company of Cleveland, Ohio, spoke on "**Structural Steel Welding.**" Present, 21 members at dinner, and a number arrived later. In addition about 39 non-members, who were interested in the subject, came in to hear the address.

Dec. 10.—No speaker on this evening; the time being devoted to the election of officers for the ensuing year.

The Papers and Entertainment Committee, and W. B. Pennock, Jr.E.I.C., and E. G. Ryley, A.M.E.I.C., merit the thanks of the branch for their efforts during the year. They work under difficulties here, owing to the small number of speakers available and the reluctance of the branch members to prepare and present papers.

On February 20th the branch was honoured by having Major George A. Walkem, M.E.I.C., president of The Institute, as its guest at an impromptu luncheon in the Prince Edward hotel. Major Walkem urged upon those present the necessity of the branch interesting itself in public affairs and urged a connection with the Chamber of Commerce. Following this suggestion, the Chamber of Commerce has appointed an Engineering Committee with A. J. M. Bowman, A.M.E.I.C., as chairman.

Two important matters have been referred to this committee for consideration and report, viz.: the removal of railroad tracks and yards from the river front with location of a union station, and consideration of traffic problems within the Border Cities. The committee is now giving consideration to these problems.

Financial Statement

Receipts

Balance in bank, January 1, 1926	$ 63.97	
Interest	.25	
Headquarters rebates	209.14	
Meals at meetings	171.25	
	———	$444.61

Expenditures

Meals at meetings	$218.50	
Printing notices	31.71	
Entertainment	58.03	
Camera	2.50	
Cash in bank	133.87	
	———	$444.61

Respectfully submitted,

A. J. M. Bowman, A.M.E.I.C., *Chairman.*
Will H. Baltzell, M.E.I.C., *Secretary-Treasurer.*

Calgary Branch

The President and Council,—

On behalf of the Executive Committee we beg to submit the following report on the activities of the Calgary Branch for the year ending December 31st, 1926:—

The slate of officers elected on March 15th, 1925, held office until March 13th, 1926. The following is a list of the officers elected on March 13th, 1926, for the branch year 1926-1927:—

Chairman	J. H. Ross, A.M.E.I.C.
Vice-Chairman	F. K. Beach, A.M.E.I.C.
Secretary-Treasurer	H. R. Carscallen, A.M.E.I.C.
Committee	G. P. F. Boese, A.M.E.I.C., past sec.-treas.
	A. L. Ford, M.E.I.C., past chairman
	J. Haddin, M.E.I.C.
	R. Mackay, A.M.E.I.C.
	W. St. J. Miller, A.M.E.I.C.
Ex-officio	A. S. Dawson, M.E.I.C.
	R. S. Trowsdale, A.M.E.I.C.
Auditors	O. H. Hoover, A.M.E.I.C.
	D. T. Townsend, A.M.E.I.C.
Branch News Editor	W. St. J. Miller, A.M.E.I.C.

Membership

The membership of the branch is as follows:—

	Resident	Non-Resident	Total as at Dec. 31, '26	Total at end of previous year
Members	20	5	25	25
Associate Members	45	21	66	74
Juniors	4	2	6	3
Students	2	1	3	4
Affiliates	..	..	..	1
Branch Affiliates	16	..	16	15
	87	29	116	122

Membership has fallen off slightly, due entirely to removal of members from the branch district.

Meetings

Ten executive meetings were held during the year in taking care of the business of the branch.

General meetings, dinners, luncheons, and special affairs were as follows:—

Jan. 7.—Annual dinner with entertainment provided by the Strathmore members, headed by G. H. Patrick, A.M.E.I.C.

Jan. 25.—"**Military Light Railway,**" by Major F. K. Beach, A.M.E.I.C., Dominion Water Power and Reclamation Service.

Feb. 18.—"**Underground Mapping of Oil, Gas, and Water Horizons Encountered in Drilling Explorations—Principally in Connection with Turner Valley Oil Field Development,**" by S. J. Davies, A.M.E.I.C., then petroleum engineer, Department of the Interior, now in consulting practice, Calgary). This was made an open meeting owing to the subject being of very great general interest, and resulted in the largest attendance (about 250) of any meeting in the history of the branch.

Mar. 1.—Luncheon in honour of the new president, Major Geo. A. Walkem, M.E.I.C. Address by Major Walkem.

Mar. 2.—"**Beet Sugar Manufacture,**" by C. R. Wing, superintendent of the Canadian Sugar Refineries, Raymond, Alberta. This lecture was followed by a short talk on "**Growing Beets Under Irrigation,**" by W. H. Snelson, irrigataion specialist, Dominion Water Power and Reclamation Service.

Mar. 13.—Annual meeting.

June 19.—Inspection of the plant of the Alberta Wood Preserving Company, Calgary.
June 24.—Dinner in honour of R. J. Durley, M.E.I.C., general secretary. Address by Mr. Durley.
July 24.—Automobile trip to Turney Valley oil field, including inspection of Royalite Oil Company gas scrubbing plant under personal direction of the superintendent, S. G. Coultis, M.E.I.C.
Nov. 1.—"**Some Problems of Water Power Development and Operation,**" by F. J. Robertson, A.M.E.I.C., general superintendent of the Calgary Power Company.
Nov. 15.—"**The Gas Scrubbing Plant in Turner Valley,**" by S. G. Coultis, M.E.I.C., superintendent of this plant of the Royalite Oil Company.
Dec. 6.—"Ladies' Night." Mr. James W. Davidson gave an illustrated lecture on "**The Head Hunters of Formosa.**" Supper was served after the lecture.

The average attendance at the above meetings was fifty-seven.

FINANCIAL STATEMENT

Assets		
Cash in bank	$ 312.75	
Value of bonds (net)	1,064.20	
Fees collectable from Branch Affiliates	6.00	
Rebates due from headquarters, Dec. 31, 1926	24.00	
		$1,406.95
Liabilities..........*Nil*		
Net value of assets at Dec. 31, 1925		$1,260.54
Increase in value of assets		$ 146.41
Revenue		
Balance in bank, Dec. 31, 1925	$ 124.87	
Interest on bonds and savings (net)	55.90	
Rebates	315.60	
Branch news	40.56	
Branch Affiliates	42.00	
		$ 578.93
Expenditures		
Expenses for meetings and speakers	$ 116.25	
Stenographic services	38.00	
Printing and miscellaneous	87.93	
Bank balance at Dec. 31, 1926	312.75	
Rebates due from headquarters, Dec. 31, 1926	24.00	
		$ 578.93

Audited and found correct, January 5, 1927.

D. T. TOWNSEND, A.M.E.I.C., O. H. HOOVER, A.M.E.I.C., } *Auditors.*

Respectfully submitted,

J. H. ROSS, A.M.E.I.C., *Chairman.*
H. R. CARSCALLEN, A.M.E.I.C., *Secretary-Treasurer.*

Cape Breton Branch

The President and Council,—

The Executive Committee of the Cape Breton Branch submits the following report of the branch activities for the year 1926:—

OFFICERS

The annual meeting was held last year at a dinner in the Oddfellows' Hall, Sydney, on December 9th. The following officers were elected:—

Chairman ....W. C. Risley, M.E.I.C.
Committeemen ....J. J. McDougall, M.E.I.C.
J. R. Morrison, A.M.E.I.C.

Those remaining on the executive from the year before were:—

S. C. Mifflen, A.M.E.I.C.
W. E. Clarke, M.E.I.C.
W. S. Wilson, A.M.E.I.C.

At the first meeting of the new executive, held on January 4th, W. S. Wilson, A.M.E.I.C., was appointed vice-chairman.

MEMBERSHIP

The number of resident branch members last year was thirty-four; it is now thirty-six, including one Affiliate and three Branch Affiliates.

MEETINGS

In February permission was granted by Council to hold a Maritime Professional Meeting in Cape Breton. This meeting was held on August 17th, 18th and 19th, and was very successful. About fifty out-of-town guests attended. Two technical papers were presented at this meeting: "**The Characteristics and Utilization of Nova Scotia Coals,**" by W. S. Wilson, A.M.E.I.C., and M. W. Booth, M.E.I.C., and "**The Humber Development of the Newfoundland Power and Paper Company,**" by H. C. Brown, A.M.E.I.C.

In addition to the above the following meetings were held during the year:—

Dec. 9.—Annual meeting, at which H. J. Kelly, general manager of steel plants, British Empire Steel Corporation, was the speaker.
Feb. 9.—"**Bills of Exchange,**" by His Honour, Judge Walter Crowe.
Apr. 13.—"**A Visit to the Coal Mines of Great Britain,**" by A. L. Hay, M.E.I.C., assistant mining engineer, Dominion Coal Company, Limited.
Sept. 2-7.—Visit to the Humber Valley, Newfoundland.
Nov. 18.—"**The Rouyn Gold District,**" by H. V. Haight, M.E.I.C., chief engineer, Canadian Ingersoll Rand, Limited, Sherbrooke.
Nov. 23.—"**Mechanical Aids at the Coal Face, Part I,**" by A. F. Cagney, director of Peacock Bros., Montreal.

FINANCIAL STATEMENT

Receipts		
On hand Dec. 8, 1925	$220.40	
Rebates from headquarters for dues and branch news	190.09	
Sale of dinner tickets	70.00	
Rebate from Halifax Branch in connection with Halifax Professional Meeting	12.50	
Branch dues	161.00	
Maritime Professional Meeting	773.04	
		$1,427.03
Expenditures		
Rent for year	$180.00	
Expenses annual dinner, 1925	96.80	
Expenses Maritime Professional Meeting	914.21	
Printing and stationery	19.65	
Postage, telephone and telegrams	15.40	
Presentations and entertaining	25.50	
		$1,427.03
Leaving a balance on hand of	$175.47	

Respectfully submitted,

W. C. RISLEY, M.E.I.C., *Chairman.*
D. W. J. BROWN, JR.E.I.C., *Secretary-Treasurer.*

Edmonton Branch

The President and Council,—

We beg to submit below the annual report of the Edmonton Branch for the year 1926.

Lectures have been given or papers read at the general meetings as follows:—

Jan. 20.—Mr. W. Dixon Craig spoke on the subject of "The Law and the Engineer."
Feb. 23.—Mr. J. Bathe Weig gave an address on the subject of "Straw Paper Making."

MEMBERSHIP

The branch membership in comparison with the same date in 1925 is as follows:—

	1925 Branch Resident	1925 Branch Non-Res.	1926 Branch Resident	1926 Branch Non-Res.
Members	15	2	16	2
Associate Members	46	8	30	5
Juniors	5	1	2	2
Students	10	0	2	1
Affiliates	2	0	2	0
Total	78	11	52	10

The branch regrets the loss through death of Lieut.-Col. Bryce Johnston Saunders, M.E.I.C., who was a distinguished member and one of Edmonton's best known and popular citizens.

During August a party composed of members of the American Society of Civil Engineers visited Edmonton and were entertained by branch members.

R. J. Durley's visit to Edmonton was very much appreciated by the branch.

FINANCIAL STATEMENT

Revenue	
Balance on hand Jan. 1, 1926	$ 79.06
Feb. 8th—Branch Affiliates dues	5.00
Apr. 27th—Refund for express	1.00
June 23rd—Rebates from headquarters	102.30
June 23rd—Branch news	1.49
Oct. 20th—Rebates from headquarters	12.60

Oct. 20th—Branch news	.80	
Dec. 21st—Rebates from headquarters	8.55	
Dec. 31st—Rebates from headquarters	12.30	
		$223.10
Expenditure		
Total disbursements	$ 75.57	
Balance at Dec. 31, 1926	147.53	
		$223.10

Respectfully submitted,

ALEX. RITCHIE, A.M.E.I.C., *Secretary-Treasurer.*
T. W. WHITE, A.M.E.I.C., *Chairman.*

Halifax Branch

The President and Council,—

During the year 1926 the Halifax Branch held eight meetings, most of which have taken the form of supper-meetings.

The branch was fortunate in obtaining speakers who presented very attractive subjects which, in one way or another, were of interest to almost every member. The attendance was very good and it was particularly gratifying because, on account of the prevailing industrial conditions, many members were out of town.

It was decided that the vice-chairman each year would automatically become chairman of the Papers Committee, and that the member elected in December would arrange for a programme of papers to cover the following fall and winter seasons. This means that the incoming executive takes office in the middle of a prearranged programme and so there is no confusion. The new vice-chairmen then has all the winter and summer in which to arrange the programme for the next season. This scheme has proved to be very satisfactory, and we have been able to publish our programme in advance.

Many members were fortunately able to attend the Maritime Professional Meeting in Sydney, which was of a very high order.

The general secretary, R. J. Durley, M.E.I.C., paid a visit to the branch in September, and a special luncheon was held at the Waegwoltic Club in his honour.

Three prizes were offered this year for a competition for engineering students at the Nova Scotia Technical College or affiliated universities for a paper describing some engineering work with which they had been connected during the previous summer.

A feature of the annual meeting and banquet was an address on "Industrial Relations," by Prof. A. Stanley Walker of King's University, which gave the members a new and broader outlook of the present labour unions. Valuable prizes were offered for "stunts" by the members, which certainly livened the meeting and provided some novel entertainment.

Taken generally, 1926 has been a very successful year.

MEETINGS

The meetings during the year were as follows:—

Jan. 28.—Regular monthly meeting in the Green Lantern, W. A. Winfield, M.E.I.C., chairman. H. F. Pickings, A.M.E.I.C., and C. St.J. Wilson gave an illustrated description of **"The Power and Pulp Developments Centred at Corner Brook, Newfoundland."**

Feb. 17.—Regular monthly meeting in the Green Lantern. To accommodate the larger attendance supper was served in the large banquet hall. H. W. L. Doane, M.E.I.C., chairman. F. A. Gaylord, manager, A. P. W. Pulp and Paper Company, Limited, gave the illustrated lecture on **"The Manufacture of Pulp and Paper,"** with particular reference to the mills at Sheet Harbour, N.S., and the fire protection of the company's timber areas. Present 53.

Mar. 3.—Regular monthly meeting in the Green Lantern. H. W. L. Doane, M.E.I.C., chairman. At the request of the chairman, J. W. MacDonald, Jr.E.I.C., of the engineering staff of the Imperial Oil Company, gave an account of the investigation into the bursting of the steel tank used for the storage of water at Imperoyal. H. S. Van Scoyoc, M.E.I.C., consulting engineer, Canada Cement Company, spoke on **"The Construction of the Toronto-Hamilton Highway,"** and on **"The Manufacture of Cement."** Each subject was illustrated by motion pictures. Present 24.

Apr. 1.—Regular monthly meeting held in the Green Lantern. H. W. L. Doane, M.E.I.C., chairman. Branch decided to offer prizes for a student essay competition. T. J. Locke, district engineer, Department of Public Works, read a paper on **"The Harbours of Nova Scotia and What They Mean to Us."** Present 29.

Sept. 15.—Special luncheon-meeting held at the Waegwoltic Club in honour of the visiting general secretary, R. J. Durley, M.E.I.C. H. W. L. Doane, M.E.I.C., chairman. Present 21.

Oct. 5.—Regular monthly meeting held in the Green Lantern. H. W. L. Doane, M.E.I.C., chairman. F. R. Faulkner, M.E.I.C., C. H. Wright, M.E.I.C., and W. F. McKnight, A.M.E.I.C., were appointed the 1927 Nominating Committee. A. G. Dalzell, M.E.I.C., consulting engineer, of Montreal, spoke on **"The Engineer and the Immigration Policy."** Present 22.

Nov. 11.—Regular monthly meeting held in the Green Lantern. H. W. L. Doane, M.E.I.C., chairman. J. H. Winfield, M.E.I.C., managing director, Maritime Telephone and Telegraph Company, gave an address on **"Executive Training for Engineers."** Present 27.

Dec. 16.—Annual meeting and dinner in the St. Julien room of the Halifax hotel. Chairman, H. W. L. Doane, M.E.I.C. The speaker of the evening was Prof. A. Stanley Walker, who addressed the members on **"Industrial Relations."** The presentation of prizes in Students' Essay Competition and the election of officers for 1927 took place at this meeting. Present 78.

FINANCIAL STATEMENT

Receipts		
Rebates and branch news	$240.26	
Dues Branch Affiliates	6.00	
Meetings	56.95	
Interest on bank deposit	1.73	
Subscription 1925 Professional Meeting	2.00	
Cash on hand and rebates due from headquarters Jan. 1, 1926	134.34	
Rebates from Headquarters, Nov. and Dec. 1926	23.87	
		$465.15
Expenditures		
Meetings	$183.52	
Postage	17.26	
Telegrams, etc.	9.09	
Addressing and maintaining mailing list	3.50	
Clerical help	60.00	
Miscellaneous	3.00	
Maritime Professional Meeting, 1926	45.00	
Printing	2.50	
Essay competition prizes	30.00	
Rebates Maritime Professional Meeting, 1925	50.00	
Journal subscriptions, Branch Affiliates	4.00	
Cash on hand	33.41	
Rebates from Headquarters, Nov. and Dec. 1926	23.87	
		$465.15
Accounts Payable		
Printing		$ 64.00

Audited Dec. 28, 1926. D. WALTER MUNN, A.M.E.I.C.
F. R. FAULKNER, M.E.I.C.

Respectfully submitted,

K. L. DAWSON, A.M.E.I.C., *Secretary.*

Hamilton Branch

The President and Council,—

The Executive Meeting of the Hamilton Branch submits the following report for the year 1926.

The branch year dates from June 1st, so that there are two executive committees during 1926 as follows:

	January to May	June to December
Chairman	C. J. Nicholson, A.M.E.I.C.	L. W. Gill, M.E.I.C.
Vice-Chair.	F. P. Adams, A.M.E.I.C.	W. L. McFaul, M.E.I.C.
Sec.-Treas.	H. B. Stuart, A.M.E.I.C.	W. F. McLaren, M.E.I.C.
Com'te.	W. L. McFaul, M.E.I.C., (1 yr.)	H. A. Lumsden, M.E.I.C., (1 yr.)
	L. W. Gill, M.E.I.C., (1 yr.)	G. R. Marston, A.M.E.I.C., 1 yr.)
	H. A. Lumsden, M.E.I.C., (2 yrs.)	F. P. Adams, A.M.E.I.C., (2 yrs.)
	G. R. Marston, A.M.E.I.C.,	A. H. Munson, A.M.E.I.C., (2 yrs.)
Br. News Editor (2 yrs.)		J. R. Dunbar, Jr.E.I.C.
Ex-officio	W. F. McLaren, M.E.I.C.	W. F. McLaren, M.E.I.C.
Emeriti	J. J. MacKay, M.E.I.C.	C. J. Nicholson, A.M.E.I.C.
		H. B. Stuart, A.M.E.I.C.

MEETINGS

The following meetings were held:

Feb. 19.—Visit of President George A. Walkem, M.E.I.C. Address on Institute affairs and general discussion.

Apr. 23.—**"A High Power Laboratory,"** by W. R. Woodward, of Pittsburgh. This was a joint meeting with the Toronto section A.I.E.E. held in the Westinghouse auditorium. After the meeting refreshments were served by the Canadian Westinghouse Co. Attendance, 200.

Oct. 20.—Addresses by J. J. MacKay, M.E.I.C., on **"The Work of the Hamilton Harbour Commission,"** and W. L. McFaul, M.E.I.C., on **"The Hamilton Water Works."** The appointment of the new executive committee was ratified at this meeting. Attendance, 24.

Nov. 25.—"**The Geology of the Hamilton District,**" by Prof. A. P. Coleman, M.A., Ph.D., F.R.S., of the University of Toronto. Attendance, 180.

Dec. 14.—"**The Manufacture of Carbon Products,**" by J. C. Webster, National Carbon Co., Toronto, with moving pictures illustrating the various operations at the main plant at Cleveland. Refreshments were served. Attendance, 40.

Membership

	Dec. 31st, 1925 Res.	Non-res.	Total	Dec. 31st, 1926 Res.	Non-res.	Total
Members	18	7	25	18	6	24
Associate Members	40	22	62	40	10	50
Juniors	10	6	16	8	4	12
Students	27	20	47	24	13	37
Branch Affiliates	34	0	34	29	0	29
Total			184			152

Financial Statement, 1926

Receipts

Brought forward	$465.06	
Rebates	223.35	
Branch news	6.27	
Journal subscriptions	4.00	
Branch Affiliate fees	96.00	
		$794.68

Expenditures

Printing and postage	$ 42.20	
Rent of halls	22.50	
Refreshments	61.70	
Expenses of lecturers	5.40	
Stenographer	50.00	
Journal subscriptions	4.00	
Advertising	7.50	
Balance	601.38	
		$794.68

Respectfully submitted,

L. W. Gill, M.E.I.C., *Chairman.*
W. F. McLaren, M.E.I.C., *Secretary-Treasurer.*

Kingston Branch

The President and Council,—

On behalf of the Executive Committee of the Kingston Branch, we beg to submit the following report on the activities of our branch from January 1st, 1926, to December 31st, 1926.

Due to the fact that the science staff and students at Queen's University compose a large part of the membership of the branch, it is found feasible to hold meetings only during the first and last three or four months in the year. No meetings are attempted in the summer and autumn. Usually the records of the branch show some ten or twelve papers as having been delivered in the course of the year, but during 1926 the number was reduced to four. Troublesome conflicts accounted for a lesser number than usual in the spring, and the Queen's Endowment campaign, which took intensive form in Kingston during November and December, precluded the possibility of any fall meetings until late in December. The attendance noted was, however, considerably greater than that of other years, averaging almost twice that of 1925.

Meetings

The four meetings held were as follows:—

Jan. 21.—"**Mining Operations in Northwestern Quebec,**" and "**The Objects and Aims of the Professional Engineers' Association of Ontario,**" by Prof. S. N. Graham, of Queen's University.

Feb. 8.—"**The Diversion of Water at Chicago and its Effect on the Levels of the Lower Lakes and Rivers,**" by Mr. Francis King, K.C., of Kingston.

Mar. 17.—"**The Chicago Drainage Canal,**" by J. L. Busfield, M.E.I.C.

Dec. 10.—Annual business meeting and address on "**The Mercury Mines of Spain,**" by Dr. E. L. Bruce, of Queen's University.

Membership and Officers

The approximate membership of the branch is as follows:—

Honorary Members	1
Members	12
Associate Members	17
Junior Members	3
Student Members	8
Affiliate	1
Total	42

Executive Committee

The executive officers holding office during the parts of the two years covered by this report are as follows:—

1925-1926		1926-1927
R. J. McClelland, A.M.E.I.C.	Chairman	Prof. L. T. Rutledge, M.E.I.C.
Prof. L. T. Rutledge, M.E.I.C.	Vice-Chair	Prof. D. S. Ellis, A.M.E.I.C.
G. J. Smith, A.M.E.I.C.	Sec.-Treas.	G. J. Smith, A.M.E.I.C.
Prof. D. S. Ellis, A.M.E.I.C.	Executive	J. M. Campbell, M.E.I.C.
Prof. D. M. Jemmett, A.M.E.I.C.		Dr. L. F. Goodwin, M.E.I.C.
J. M. Campbell, M.E.I.C.		Prof. A. Jackson, A.M.E.I.C.

Financial Statement

The following is the financial statement for the year 1926:—

Receipts

Jan. 1	Balance brought forward	$ 81.57	
June 15	Rebates on fees	66.30	
June 15	Branch news	7.23	
June 31	Bank interest	.94	
Oct. 20	Rebates on fees	22.50	
Dec. 15	Rebates on fees	5.10	
Dec. 31	Accounts receivable	3.90	
			$187.54

Disbursements

Jan. 7	Bank exchange	$ .15	
Apr. 21	Expenses—J. L. Busfield	12.50	
Apr. 21	Expenses—R. J. McClelland	13.35	
Apr. 21	Cards, printing and postage to date	6.85	
Dec. 1	Secretary's honorarium	50.00	
Dec. 27	Cards, printing, postage, exchange and stationery to date	2.90	
Dec. 31	Accounts payable	0.00	
Dec. 31	Balance carried forward	101.79	
			$187.54

Respectfully submitted,

L. T. Rutledge, M.E.I.C., *Chairman.*
Gordon J. Smith, A.M.E.I.C., *Secretary-Treasurer.*

Lakehead Branch

The President and Council,—

On behalf of the Executive Committee we beg to submit the following annual report of the Lakehead Branch:

Membership

On January 1st, 1926, there were 40 corporate members and 18 non-corporate members, and on December 31st, 1926, there were 36 corporate members and 8 non-corporate members, showing a loss during the year of 4 corporate and 10 non-corporate members. This loss is due to change of residence in most cases, the balance being struck off the roll for non-payment of dues.

Meetings

Meetings of the Lakehead Branch were held as follows:—

Apr. 28.—A dinner was held at the Shuniah Club, Port Arthur, at which J. Antonisen, M.E.I.C., gave a most interesting address on "**The Art of Living.**"

July 13.—A dinner was held at the Prince Arthur hotel, Port Arthur, in honour of the general secretary, R. J. Durley, M.E.I.C., who was paying his annual visit to the branch. Mr. Durley gave a most interesting address on Institute affairs, and on conditions as seen by him on his trip through the west. We also had an address from Mr. Francis Kiefer, of Port Arthur, on "**Forestry.**" Besides Mr. Durley, our guests at the dinner were Hon. Dr. Forbes-Godfrey, Dr. Bell of Toronto, Hon. F. H. Keefer, Col. Milton Francis, Mayor of Port Arthur, Dr. Laurie, and Messrs. Wynne-Roberts and Falkner, of the Toronto Branch.

Oct. 20.—A dinner was tendered Major Geo. A. Walkem, M.E.I.C., president of the Institute, at the Shuniah Club. Major Walkem addressed the members on Institute matters, and on his visit to the annual meeting of the American Society of Civil Engineers at Philadelphia; the power and pulp plants on the Saguenay; the plant of the Aluminum Company of Canada at Arvida. The president's visit, like that of the general secretary's, is always looked forward to by the Lakehead members. Major Walkem, during his stay with us, very kindly addressed the pupils of the collegiates in both cities on engineering and engineering courses.

The result of the ballot for officers of the branch for the year was announced at the dinner, resulting as follows:—

Chairman ....C. B. Symes, A.M.E.I.C.
Vice-Chairman ....D. G. Calvert, A.M.E.I.C.
Secretary-Treasurer ....Geo. P. Brophy, A.M.E.I.C.
Executive Committee......D. C. Chisholm, M.E.I.C.
J. C. Meader, A.M.E.I.C.
W. H. Souba, M.E.I.C.
M. W. Turner, A.M.E.I.C.

Owing to Mr. Turner's transfer to Winnipeg, G. R. Duncan, A.M.E.I.C., who was next on the list, was elected to take Mr. Turner's place.

At an Executive meeting the following branch committees were appointed:—

Nominating Committee—H. G. O'Leary, A.M.E.I.C., R. B. Chandler, M.E.I.C.

By-laws Committee—D. G. Calvert, A.M.E.I.C., J. C. Meader, A.M.E.I.C.

Membership Committee—G. R. Duncan, A.M.E.I.C., (Chairman), H. M. Lewis, A.M.E.I.C., D. C. Chisholm, M.E.I.C.

Programme Committee, Fort William—H. G. O'Leary, A.M.E.I.C., (Vice-Chairman), R. J. Askin, A.M.E.I.C., W. J. Hoover, Port Arthur, R. B. Chandler, M.E.I.C., (Vice-Chairman), W. T. Moodie, M.E.I.C., F. C. Graham, A.M.E.I.C.

The following members were nominated to represent the Lakehead Branch on the Council of the Institute:—

M. W. Jennings, A.M.E.I.C., J. Antonisen, M.E.I.C.

FINANCIAL STATEMENT

Revenue		
Balance in bank, Dec. 31, 1925	$117.78	
Rebates on fees	87.90	
Dinner, April 28, 1926	21.00	
Dinner, July 13, 1926	37.00	
Dinner, Oct. 20, 1926	18.00	
Interest	2.06	
		$283.74
Expenditure		
Telegrams	4.38	
Postage	10.00	
Printing	5.60	
Exchange on cheques	.30	
Dinner, April 28, 1926	25.00	
Dinner, July 13, 1926	60.70	
Dinner, Oct. 20, 1926	22.00	
Express	1.60	
Sundries	16.70	
Balance in bank, Dec. 31, 1926	130.96	
Cash on hand	6.50	
		$283.74

Respectfully submitted,

C. B. SYMES, A.M.E.I.C., *Chairman.*
GEO. P. BROPHY, A.M.E.I.C., *Secretary-Treasurer.*

Lethbridge Branch

The President and Council,—

On behalf of the Executive Committee of the Lethbridge Branch we beg to submit the following report for the year ending December 31st, 1926:—

The officers elected March 7th, 1925, held office until the end of the branch year, March 6th, 1926. On this date the following officers were elected for the ensuing branch year:—

Chairman ....J. T. Watson, A.M.E.I.C.
Vice-Chairman ....G. N. Houston, M.E.I.C.
Secretary-Treasurer ....N. H. Bradley, A.M.E.I.C.
Committee ....J. B. deHart, M.E.I.C.
Chas. Raley, A.M.E.I.C.
A. Thomson, A.M.E.I.C.
Ex-officio ....Robt. Livingstone, M.E.I.C.
John Dow, M.E.I.C.
Auditors ....G. S. Brown, A.M.E.I.C.
C. J. Broderick.

MEMBERSHIP

The membership of the branch is as follows:—

	Branch Resident	Branch Non-Resident	Total as at Dec. 31, '26	Total as at Dec. 31, '25
Members	9	1	10	9
Associate Members	22	6	28	30
Juniors	..	1	1	1
Students	..	1	1	4
Affiliates	..	1	1	1
Branch Affiliates	18	..	18	26
	—	—	—	—
Total	49	10	59	71

FINANCIAL STATEMENT

(End of Branch year—March 6th, 1926.)

Receipts			
Balance on hand, Mar. 7, 1925		$119.77	
Bank interest		2.71	
Rebates from headquarters		99.00	
Received from Branch Affiliates:			
Dues and Journal subscriptions, 1925	$51.15		
" " " " 1926	41.00		
		$ 92.15	
Branch news		14.89	
Dan McCowan meeting		93.10	
			$421.62
Expenditures			
Bank exchange		$ 0.87	
Printing regular cards		45.75	
Music, speakers, and entertainers' expense		69.25	
Branch Affiliate Journal subscriptions		44.15	
Office expenses		19.28	
Dan McCowan meeting		123.45	
Balance in bank, Mar. 1, 1926		118.87	
			$421.62
Assets			
Rebates due for 1926		$ 87.00	
Branch Affiliates, Journal subscriptions		52.00	
Cash in bank, Mar. 1, 1926		118.87	
			$257.87
Liabilities			
Branch Affiliates, Journal subscriptions		$ 30.00	
			$ 30.00

We have examined the vouchers and papers of the Lethbridge Branch of the Engineering Institute of Canada, also statement drawn by N. H. Bradley, secretary-treasurer, and find same to be a correct and true account of the standing of the branch.

FINANCIAL STATEMENT

(From March 1st to December 31st, 1926.)

Receipts		
Cash in bank, Mar. 1, 1926	$118.87	
Bank interest	3.48	
Rebates from headquarters	84.30	
Rebates due from headquarters	14.70	
Branch Affiliates, fees	50.00	
Branch news	11.05	
		$282.40
Disbursements		
Bank exchange	$ 0.60	
Printing meeting notices	21.70	
Meeting expenses, music, speakers and entertainment	37.85	
Branch Affiliates, Journal subscriptions	34.00	
Office expenses, stamps, etc.	9.91	
Bank balance, Dec. 31, 1926	163.64	
Rebates balance due from headquarters	14.70	
		$282.40
Assets		
Cash in bank, Dec. 31, 1926	$163.64	
Rebates due from headquarters	14.70	
		$178.34
Liabilities		
Accounts payable (estimated)	$ 30.00	

C. J. BRODERICK, }
W. G. ALDOUS, } *Auditors.*

MEETINGS

The Executive held five meetings during the year, and in addition there were nine regular, two special, and one joint meetings held.

The special meetings were the occasion of the visit of R. J. Durley, M.E.I.C., general secretary, on July 7th, and the visit of The Institute's president, Major Geo. A. Walkem, M.E.I.C. On December 18th a joint meeting with the Professional Engineers of Alberta was addressed by the Association president, B. L. Thorne, M.E.I.C.

Jan. 9.—"**Technical Education in the Province of Alberta,**" by A. G. Carpenter, director of technical education for Alberta.

Jan. 23.—"**Gothic Architecture,**" by H. M. Whiddington, Lethbridge.

Feb. 6.—"**The Art of Communication,**" by A. M. Mitchell, auditor, Alberta Government Telephones.

Feb. 20.—"**The Research Council of Alberta,**" by Edgar Stansfield, M.E.I.C., research engineer, Edmonton.

Mar. 6.—Branch annual meeting.

July 7.—"**Institute Affairs.**" Special meeting addressed by R. J. Durley, M.E.I.C., general secretary of The Institute.

Sept. 25.—"**Vancouver Harbour Developments,**" by Major Geo. A. Walkem, M.E.I.C., president of The Institute.

Oct. 23.—"**Brick and Clay Products,**" by E. H. Sellhorn, manager, Redcliff Brick and Coal Company, Medicine Hat.

Nov. 6.—"**The Modern Steam Turbine,**" by J. T. Watson, A.M.E.I.C., Lethbridge power plant superintendent.
Nov. 20.—"**Hydro Power,**" by A. B. Sanborn, manager, East Kootenay Power Company, Fernie, B.C.
Dec. 4.—"**Geological Problems of the Spray Lake Water Power Project,**" by Dr. John A. Allan, professor of geology, Alberta University, Edmonton.
Dec. 18.—Joint meeting with Professional Engineers of Alberta, addressed by B. L. Thorne, M.E.I.C., on "**The Sullivan Mine and Trail Smelter.**"

Respectfully submitted,

J. T. Watson, A.M.E.I.C., *Chairman.*
N. H. Bradley, A.M.E.I.C., *Secretary-Treasurer.*

London Branch

The President and Council,—

On behalf of the executive committee of the London Branch we beg to submit the following report for the year ending December 31st, 1926:

During the year six executive meetings and six regular meetings were held.

The annual dinner meeting on January 20th was addressed by Prof. Kingston of the University of Western Ontario, his subject being "**Wonders of the Skies.**" The address was illustrated with lantern slides. Vocal music by two soloists was much appreciated during the evening.

On February 18th the branch was honoured with the presence of President Geo. A. Walkem, M.E.I.C., who spoke on some interesting phases of engineering in British Columbia.

A dinner meeting was held on April 22nd to which the members of the branch were pleased to welcome General Secretary R. J. Durley, M.E.I.C., who gave an instructive outline of administration at headquarters. Mr. W. E. Piper of the Dorr Company of New York spoke on "**The Paracycle Pump and Compressor.**"

On May 15th a meeting was held at Woodstock, preceded by a trip of inspection which included the plant of the Independent Concrete Pipe Company, the Woodstock activated sludge sewage disposal plant, the waterworks pumping plant and the springs which are the source of the city water supply. The speaker of the evening was Wm. Storrie, M.E.I.C., and his subject, "**Engineering and Public Health.**"

On October 2nd the branch held its second motor trip to the Niagara Peninsula. Members of the Welland Ship Canal staff acted as guides over the entire length of the new canal, and Major A. W. L. Butler, A.M.E.I.C., a member of the staff, gave a very interesting illustrated address on the canal, at the evening meeting. The water filtration plant of St. Catharines, was also visited.

The last regular meeting of the year was held at the London Technical High School on December 17th. Principal H. B. Beal addressed the meeting on "**Vocational Education for Industrial Purposes.**" The address was followed by an inspection of the school.

Membership

The membership of the London Branch is as follows:—

	1925	1926
Members	13	12
Associate Members	32	30
Juniors	5	6
Students	35	10
Total	85	58

The decrease in membership is due to the removal by headquarters of the names of a number of Student members.

Financial Statement

Receipts

Balance in bank Jan. 1, 1926	$ 91.99	
Donations	8.00	
Rebates from headquarters (dues and branch news)	131.73	
		$231.72
Rebates due from headquarters	.60	
		$232.32

Expenditures

Notices, postage	$ 9.49	
Cigars for dinners	6.25	
Telegrams and long distance calls	.64	
Dinner, April 22nd	13.00	
Entertaining dinner guests	4.00	
Janitor services	5.00	
Flowers	12.00	
Discount on cheque	.15	
Balance in bank, Dec. 31st, 1926	181.19	
		$231.72
Rebates due from headquarters	.60	
		$232.32

We have examined the above statement prepared by the secretary-treasurer and find the same to be a correct and true account of the financial standing of the London Branch.

Respectfully submitted,

W. M. Veitch, A.M.E.I.C., } *Auditors.*
R. W. Garrett, A.M.E.I.C., }

Respectfully submitted,

W. P. Near, M.E.I.C., *Chairman.*
Frank C. Ball, A.M.E.I.C., *Secretary-Treasurer.*

Moncton Branch

The President and Council,—

On behalf of the Executive Committee, we beg to submit the seventh annual report of Moncton Branch.

The Executive Committee held six meetings during the year. There were nine meetings of the branch held, four of which were supper-meetings and two were open to the public. One meeting was held at Sackville for the benefit of the engineering students of Mount Allison University. A special meeting was held during the summer, at which we had the pleasure of having with us the general secretary, R. J. Durley, M.E.I.C., who gave a very interesting address on Institute affairs.

Membership

The membership at present is as follows:—

	Resident	Non-Resident
Members	7	2
Associate Members	24	7
Juniors	5	2
Students	6	1
Affiliates	1	..
Total	43	12

During the year the branch suffered the loss of two of its most prominent members in the death of J. S. O'Dwyer, M.E.I.C., right-of-way engineer, Canadian National Railways, Moncton, and K. S. Pickard, M.E.I.C., manager of the Sackville Light and Power Company, Sackville, N.B.

Executive Committee

The annual meeting of the branch was held on June 6th and the following officers were elected for 1926-27:—

Chairman	A. S. Gunn, A.M.E.I.C.
Vice-Chairman	G. C. Torrens, A.M.E.I.C.
Secretary-Treasurer	V. C. Blackett, A.M.E.I.C.
Executive Committee	Prof. F. L. West, A.M.E.I.C.
	James Pullar, A.M.E.I.C.
	G. E. Smith, A.M.E.I.C.

The members of the Executive Committee for 1926-27, in addition to the above, are as follows:—

A. F. Stewart, M.E.I.C.
J. D. McBeath, M.E.I.C.
J. R. Freeman, A.M.E.I.C.
F. O. Condon, M.E.I.C. (ex-officio)
C. S. G. Rogers, A.M.E.I.C. "
M. J. Murphy, A.M.E.I.C. "

Financial Statement

The financial statement for the year ending December 31st, 1926, is as follows:—

Revenue

Balance in bank, January 1st, 1926	$103.31	
Cash on hand, " " "	2.16	
Rebates on dues and branch news	122.33	
Tickets sold for supper-meetings	91.00	
Bank interest	2.28	
Refund from Halifax Branch on our contribution towards Maritime Professional Meeting	12.50	
Miscellaneous	.30	
Rebates due from headquarters	5.40	
		$339.28

Expenditures

Expenses of meetings	$134.96	
Postage	4.30	
Printing	38.63	
Telegrams and telephones	4.43	
Contribution towards Maritime Professional Meeting	15.00	
Miscellaneous	69.85	
Balance in bank	59.38	
Cash on hand	7.33	
Rebates due from headquarters	5.40	
		$339.28

Respectfully submitted,

V. C. Blackett, A.M.E.I.C., *Secretary-Treasurer.*
A. S. Gunn, A.M.E.I.C., *Chairman.*

Montreal Branch

The President and Council,—

On behalf of the Executive Committee we beg to make the following report covering the activities of the Montreal Branch for the year 1926.

The Executive Committee

The personnel of the Executive Committee during the past year is given in the following table:—

Name	*Office, etc.*
C. J. Desbaillets, M.E.I.C.	Chairman, 1926.
C. V. Christie, M.E.I.C.	Vice-Chairman, 1926.
A. Duperron, A.M.E.I.C.	Elected, 1926-1927.
A. R. Ketterson, M.E.I.C.	Elected, 1926-1927.
J. A. McCrory, M.E.I.C.	Elected, 1926-1927.
P. L. Pratley, M.E.I.C.	Elected, 1925-1926.
Jas. Robertson, A.M.E.I.C.	Elected, 1925-1926.
F. C. Laberge, M.E.I.C.	Elected, 1925-1926.
J. L. Busfield, M.E.I.C.	*Ex-officio*, Past Chairman & Councillor.
C. K. McLeod, A.M.E.I.C.	Secretary-Treasurer, 1926.
Arthur Surveyer, M.E.I.C.	*Ex-officio*, Past President, E.I.C.
J. M. R. Fairbairn, M.E.I.C.	*Ex-officio*, Past President, E.I.C.
R. A. Ross, M.E.I.C.	*Ex-officio*, Past President, E.I.C.
K. B. Thornton, M.E.I.C.	*Ex-officio*, Vice-President, E.I.C.
F. P. Shearwood, M.E.I.C.	*Ex-officio*.
O. O. Lefebvre, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
G. R. MacLeod, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
J. H. Hunter, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
J. T. Farmer, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
C. M. McKergow, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.

There were nine meetings of the Executive Committee during the past year, all of which were well attended. In addition to the annual meeting, held December 16th, there were also three special general meetings of the branch during the year.

Papers and Meetings Committee

The branch by-laws provide that this committee consist of a chairman and vice-chairman, and also of the chairman and vice-chairman of the various sections of the branch, who were appointed as follows:—

Chairman	R. E. MacAfee, A.M.E.I.C.
Vice-Chairman	A. Duperron, A.M.E.I.C.
Ex-officio	C. K. McLeod, A.M.E.I.C.

Civil Section	A. Plamondon, A.M.E.I.C.	Chairman
	J. S. Hall, A.M.E.I.C.	Vice-Chairman
Electrical Section	G. A. Wallace, A.M.E.I.C.	Chairman
	L. A. Kenyon, A.M.E.I.C.	Vice-Chairman
Mechanical Section	J. A. McCammon, A.M.E.I.C.	Chairman
	F. S. B. Heward, A.M.E.I.C.	Vice-Chairman
Municipal Section	J. G. Caron, A.M.E.I.C.	Chairman
	J. F. Brett, A.M.E.I.C.	Vice-Chairman
Railway Section	D. Hillman, M.E.I.C.	Chairman
	J. A. Ellis, A.M.E.I.C.	Vice-Chairman
Student Section	L. A. Duchastel, S.E.I.C.	Chairman
	H. L. Johnston, Jr.E.I.C.	Vice-Chairman

This committee held five meetings during the year, at which the average attendance was nine. We feel that the programme of twenty-eight meetings arranged by this committee and the many outstanding speakers obtained, is sufficient proof of the work which they have done.

Reception Committee

A Reception Committee, under the chairmanship of H. G. Thompson, Jr.E.I.C., together with S. A. Neilson, A.M.E.I.C., E. T. Harbert, S.E.I.C., H. M. Morris, S.E.I.C., H. S. Petford, A.M.E.I.C., E. Roy, A.M.E.I.C., was appointed.

This committee has been on hand at every meeting of the branch and has kept the various records of attendance, which are reported further on in this report.

Publicity Committee

At the commencement of the year S. A. Neilson, A.M.E.I.C., and E. Prevost, Jr.E.I.C., constituted the Publicity Committee and did very valuable work. However, during the early part of the session Mr. Prevost resigned, as he was leaving town on business, and later in the year Mr. Neilson had to abandon his duties due to pressure of business in other directions. H. W. B. Swabey, M.E.I.C., was appointed to replace Mr. Neilson and E. Norman, Jr.E.I.C., to replace Mr. Prevost. The activities of this committee resulted in very satisfactory attention on the part of both the English and French newspapers. Their activities were also responsible for revenue obtained for Branch News to the amount of $66.34.

Special Committees

From time to time special committees have been appointed for carrying out of particular duties, amongst those might be mentioned the visit to Isle Maligne and the International Electrotechnical Commission. The latter item being reported more fully later on.

Nominating Committee

Following out the requirements of the By-laws, a Nominating Committee for the purpose of making nominations for the 1926 Executive Committee were appointed. Two members, namely, C. J. Desbaillets, M.E.I.C., and C. K. McLeod, A.M.E.I.C., were appointed at a regular meeting of the Executive Committee on October 25th, and H. W. B. Swabey, M.E.I.C., J. G. Caron, A.M.E.I.C., and W. C. Adams, M.E.I.C., were elected at a special meeting of the branch on October 28th.

Weekly Meetings

The meetings for the first half of the year were arranged by the Papers and Meetings Committee under the chairmanship of J. L. Busfield, M.E.I.C., and the meetings of the latter half, i.e., since October, have been arranged by the committee under the chairmanship of the R. E. MacAfee, A.M.E.I.C.

A complete list of meetings as held through the year is given in the following table, together with the total attendance:

Meetings—1926

Jan. 7.—"**Features of Design and Construction of Isle Maligne Station,**" by W. S. Lee, M.E.I.C. Attendance 237.

Jan. 14.—"**Effect of Personnel on Industry,**" by R. A. C. Henry, M.E.I.C. Attendance 73.

Jan. 21.—"**Pulp and Paper,**" by H. S. Taylor, M.E.I.C. Attendance 130.

Jan. 28.—"**Protective Features of Emergency Equipment of the "Montreal Aqueduct,**" by C. J. Desbaillets, M.E.I.C. Attendance 64.

Feb. 4.—"**Electrolysis,**" by P. LeBel, S.E.I.C. Attendance 120.

Feb. 11.—"**Pulverized Coal,**" by H. G. Barnhurst. Attendance 100.

Feb. 18.—"**Improvements in the General Plan of the City of Montreal,**" by Geo. R. MacLeod, M.E.I.C. Attendance 97.

Feb. 25.—"**The Development of the Outside Plant of the Bell Telephone Company,**" by W. H. Winter. Attendance 51.

Mar. 4.—"**Chicago Drainage Canal,**" by J. L. Busfield, M.E.I.C. Attendance 138.

Mar. 11.—"**Vancouver Narrows Bridge,**" by E. H. James, M.E.I.C. Attendance 70.

Mar. 18.—"**History of Locomotion, its Development and Future Possibilities,**" by W. E. Newman. Attendance 85.

Mar. 25.—"**The South Shore Bridge,**" by P. L. Pratley, M.E.I.C. Attendance 166.

Apr. 1.—"**Modern Problems of Synchronous Converters,**" by E. B. Shand. Attendance 50.

Apr. 8.—"**Cost System for a Large Engineering Establishment,**" by J. S. Houston. Attendance 61.

Apr. 15.—"**Some Features of Hemmings Falls Power Development,**" by J. S. H. Wurtele, M.E.I.C. Attendance 97.

Apr. 22.—"**History of Science,**" by Dr. L. E. Pariseau. Attendance 150.

Apr. 29.—"**Belgian State Railway,**" by Dr. F. Van Bruysel. Attendance 42.

Oct. 7.—"**Building the Town of Arvida,**" by H. R. Wake, A.M.E.I.C. Attendance 130.

Oct. 14.—"**Engineering Features in Breaking the Allegheny Ice Gorge,**" by Dr. H. T. Barnes, M.E.I.C. Attendance 156.

Oct. 21.—"**Manufacture of Carbide,**" by R. A. Witherspoon. Attendance 77.

Oct. 28.—"**Bearing Metal Bronzes,**" by H. J. Roast and F. Newell, M.E.I.C. Attendance 83.

Nov. 4.—"**The American Railway Engineering Association and Its Work,**" by J. E. Armstrong, M.E.I.C. Attendance 69.

Nov. 11.—"**Manufacture of Paper, with Special Reference to the Kraft Process,**" by J. B. Phillips. Attendance 103.

Nov. 18.—"**Use of Duralumin in the Manufacture by the Canadian Government of an all Metal Artificial Limb, with Some Detailed Information as to the Properties of Duralumin,**" by N. F. Parkinson, A.M.E.I.C. Attendance 57.

Nov. 25.—"**Hydro-Electric Development of Bryson,**" by H. E. Pawson, M.E.I.C. Attendance 103.

Dec. 2.—"**Railway Supplies,**" by L. C. Thompson. Attendance 58.
Dec. 9.—"**Building Foundations in Relation to Street Levels,**" by G. R. MacLeod, M.E.I.C. Attendance 80.
Dec. 16.—Annual meeting of Montreal Branch. Attendance 46.

Summer Excursion

Over the weekend of June 25th to 27th, some fifty-eight members and friends of the Montreal Branch visited the large industrial developments in the lake St. John district at the head of the Saguenay river. A full report of this trip is given in the August issue of the Journal.

Visit of the International Electrotechnical Commission

The Montreal Branch had the fortune this year in being privileged to entertain the delegates of the International Electrotechnical Commission on the evening of Saturday, May 1st, and during Sunday, May 2nd.

Arriving by special train at the Bonaventure station, the delegates were met by Vice-President K. B. Thornton, M.E.I.C., and conveyed by motor bus to the Windsor hotel, where rooms had been placed at the disposal of the delegates.

On Saturday evening the Commission was entertained at an informal dinner-dance in the Windsor. On Sunday morning a trip by motor bus through the city and environs was made, winding up at the Ritz-Carlton hotel, where a luncheon was given. At the luncheon Vice-President Thornton was the chairman, the address of welcome being given by Dr. Arthur Surveyer, M.E.I.C., past president of the Institute.

The delegates of this commission numbered some hundred and twenty and represented twenty-two different nationalities. Their appreciation of the entertainment may be summed up by the few words said by Signora Semenza, wife of the president, who remarked, "Since we left the European continent this is the first time we feel at home."

A special committee was formed to organize the entertainment for the International Electrotechnical Commission and was composed of K. B. Thornton, M.E.I.C., Chairman, Dr. H. T. Barnes, M.E.I.C., Frederick B. Brown, M.E.I.C., J. L. Busfield, M.E.I.C., J. B. Challies, M.E.I.C., C. V. Christie, M.E.I.C., C. J. Desbaillets, M.E.I.C., Fraser S. Keith, M.E.I.C., C. K. McLeod, A.M.E.I.C., and R. J. Durley, M.E.I.C.

The Montreal Branch was greatly assisted in its duties by the kind co-operation of the following: Bell Telephone Co. of Canada, Canadian National Railways, Montreal Light, Heat and Power Co., Montreal Tramways Company, Northern Electric Company, Shawinigan Water and Power Co., Southern Canada Power Company.

Annual and Professional Meeting

The Annual Meeting being held in Toronto on January 27th, 28th and 29th, the Executive Committee of the Montreal Branch decided to send J. L. Busfield, M.E.I.C., and C. K. McLeod, A.M.E.I.C., to Toronto to look after the interest of the branch.

Entertainment of Visitors

On the occasion of outstanding speakers visiting Montreal for the express purpose of addressing the branch, it has been the policy of the executive to entertain them at a small dinner prior to the meeting. Amongst others was W. S. Lee, M.E.I.C., of South Carolina, who addressed the branch on January 7th.

Another prominent visitor to Montreal was Sir Sefton Brancker, director of civil aviation of Great Britain. On March 19th the resident members of council and executive of the Montreal Branch entertained him at an informal luncheon at the University Club. Following the luncheon, Sir Sefton told those present of the progress that is being made in Britain in the field of civil aviation. He complimented Canada on the aerial survey work that was being done here, saying, in this particular line Canada leads the world.

Presentation of Branch Charter

Presentation to the Montreal Branch of its Charter from the parent organization was made on February 4th by Major Geo. A. Walkem, M.L.A., M.E.I.C., of Vancouver, and the president-elect of the Engineering Institute of Canada. The chairman of the branch accepted the Charter on behalf of its fellow members. Before proceeding to the formal presentation, Major Walkem delivered a short address directed particularly to the students present, upon the lives and contributions of the great men of science.

Membership

The membership of the Montreal Branch shows a slight falling off during the past year. This is no doubt due to pressure having been brought to bear on certain members who were in arrears, and we feel that the results will probably be of benefit to the branch in the long run. The analysis of the branch membership for the years 1925 and 1926 is as follows:

Statement of Membership, 1925-1926

		Dec. 31st, 1925	Dec. 31st, 1926	Increase or Decrease
Honorary Members	Resident	1	1	No change
Members	Resident	212	217	inc. 5
	Non-Resident	15	8	dec. 7
Associate Members	Resident	406	399	dec. 7
	Non-Resident	48	24	dec. 24
Juniors	Resident	65	76	inc. 11
	Non-Resident	12	8	dec. 4
Students	Resident	280	249	dec. 31
	Non-Resident	35	7	dec. 28
Affiliates	Institute	11	14	inc. 3
	Branch	20	19	dec. 1
Total		1,105	1,023	

During the past year we have with regret had to announce the loss sustained by the branch in the death of a number of its prominent members. These include:

Adams, Walter C.	Herdt, Dr. Louis A.
Barlow, John Rigney	Johnson, Phelps, LL.D.
Bertram, Maj.-Gen. Sir Alexander	Lefebvre, Henri Paul
	Loudon, Andrew C.
Ewing, James	Marchand, Art. J.
Forrest, Benj. J.	Ramsey, Col. C. W. P., C.M.G.

In the case of Major-Gen. Sir Alexander Bertram, Dr. Louis A. Herdt and Phelps Johnson, LL.D., the branch passed resolutions of regret which were forwarded to the families of the deceased.

Financial Statement

Ordinary Revenue			
Branch news		$ 58.04	
Branch Affiliate dues		168.00	
Rebates from Headquarters for dues		1,667.81	
Interest on savings account		30.94	
			$1,924.79
Extraordinary Revenue			
Sale of piano		$ 225.00	
Cash on hand, January 1st, 1926		1,108.57	
			$1,333.57
Total revenue			$3,258.36
Ordinary Expenditures			
Weekly post cards and notices		$ 630.61	
Miscellaneous printing		149.62	
Stationery and stamps		20.83	
Secretary's honorarium		300.00	
Clerical assistance		120.00	
Telephone and telegrams		62.78	
Moving picture machine, slides, etc.		39.20	
Subscription to Journal for Affiliates		46.00	
Refreshments		37.00	
Miscellaneous, gratuities, entertaining		77.33	
Speakers, travelling expenses, etc.		137.11	
			$1,620.48
Balance on hand: savings account		$1,511.74	
Overdraft: current account		57.16	
Estimated rebates due from Headquarters, Dec. 31:			
Rebates from dues	$175.00		
Branch news	8.30		
		$ 183.30	
			$1,637.88
			$3,258.36

Respectfully submitted,

C. J. Desbaillets, M.E.I.C., *Chairman.*
C. K. McLeod, A.M.E.I.C., *Secretary.*

Niagara Peninsula Branch

The President and Council,—

On behalf of the Executive Committee we beg to submit the annual report of the Niagara Peninsula Branch.

The activities of the branch were confined to one business meeting, six general meetings, four trips, and the annual dance. In addition the members of the branch were the guests of the American Waterworks Association, Canadian section, at their convention in St. Catharines in March.

The dinner-meetings were fairly well attended, when the size of the branch territory is considered, but a large proportion of the attendance is made up of non-members. The subjects were interesting and well handled by the different speakers. The average attendance was forty-seven.

The business meeting discussed the annual dance, proposed amendments to the by-laws, and branch affairs generally. The annual dance was, as usual, a social success and a financial burden. Although all trips were marred by bad weather, they were fairly well attended. The list of functions was as follows, all of which were reported at length in the Journal.

MEETINGS

Jan. 20.—Business meeting at St. Catharines. Attendance 17.
Feb. 3.—Trip over Queenston power plant, and meeting at Niagara Falls. "**Personal Experiences in Egypt,**" by D. A. Andrus, M.E.I.C. Attendance 80.
Mar. 3, 4 and 5.—Annual meeting of American Waterworks Association, Canadian section, at St. Catharines.
Apr. 7.—Annual dance.
Apr. 21.—Meeting at St. Catharines. "**The Chicago Water Diversion,**" by J. L. Busfield, M.E.I.C. Attendance 40.
May 12.—Meeting at Niagara Falls. "**Reminiscences of Many Lands,**" by Dr. J. McIntosh Bell. Attendance 59.
Sept. 25.—Meeting at Welland. Inspection of new waterworks. "**Diesel Engines,**" by Prof. E. A. Alcutt, M.E.I.C. Attendance 20.
Oct. 2, 3.—Visit of London Branch. Trip over Welland Ship Canal.
Oct. 20.—Meeting at St. Catharines. "**Hydro-Electric Development in Peru,**" by J. C. Street, M.E.I.C. Attendance 28.
Dec. 4.—Trip over International Peace Bridge, Fort Erie, and meeting at Niagara Falls. "**The International Peace Bridge,**" by Edward P. Lupfer, chief engineer. Attendance 54.

MEMBERSHIP

The membership of the branch shows a slight loss during the year.

	1925	1926	Loss	Gain
Members	18	24	..	6
Associate Members	89	78	11	..
Juniors	14	15	..	1
Students	34	30	4	..
Branch Affiliates	15	15	..	..
	170	162	15	7

FINANCIAL STATEMENT

Receipts

Balance on hand Jan. 1, 1926	$ 77.40	
Rebates and branch news	305.93	
Affiliate dues	3.00	
Proceeds of meetings	49.25	
Receipts, dance guarantee list	49.10	
Refund on postage	1.70	
		$486.38

Expenditures

Printing, stationery and notices	$ 50.00	
Expense meetings	45.35	
Postage, telephone, express, telegrams	31.96	
Condolences	3.00	
Advance to dance committee	114.72	
Branch Affiliate subscriptions	26.00	
Exchange	1.05	
Balance on hand Dec. 31, 1926	204.70	
Rebates due from headquarters	9.60	
		$486.38

Respectfully submitted.

ALEX. MILNE, A.M.E.I.C., *Chairman.*
R. W. DOWNIE, A.M.E.I.C., *Secretary-Treasurer.*

Ottawa Branch

The President and Council,—

On behalf of the Managing Committee of the Ottawa Branch, we beg to submit the following report for the calendar year 1926:—

Looking back over the activities of the branch during the past year, it is a pleasure to note the many varied interests that have been opened up or touched upon, and to bear witness to the hearty co-operation evidenced by the officers and members throughout the year.

Early in the year we were favoured by a visit from our president, and some of the points brought out in his very interesting after-luncheon talk have borne fruit. He stressed, among other things, the necessity of the engineer taking a greater interest in community affairs if he is to properly fill his special sphere of activity in the world and the necessity of showing this interest, not by sitting back as the engineer seems inclined to do, but by seeing to it that our representatives, whoever they may be, shall endeavour to so conduct themselves that the engineering body shall come to be recognized as a substantial organization, composed of intelligent, if somewhat diffident, citizens who, in spite of appearances, are willing to do their share in municipal and public affairs. A small beginning to this end was made by the inclusion of one of our members on the Ottawa Centenary Committee last summer, and recently it has been agreed that the chairman of the branch shall be a member of the local Board of Trade. It is hoped that this is but a beginning of a really active interest on the part of the branch and its members in public affairs generally.

During the year the managing committee held eleven meetings. In addition, the branch held eight evening meetings and ten luncheons. The usual joint smoker with the Professional Institute of the Civil Service of Canada was a feature of the year's activities. The branch was able also to co-operate actively and gratifyingly with the Rotary Club in connection with the visit to Ottawa in May last of the delegates to the International Electro-technical Commission. The trip to the construction works at Chelsea, where the Fraser-Brace Engineering Company acted as hosts for the International Paper Company, was most enjoyable. Another outstanding feature was the opportunity afforded the members of having as their guest at luncheon Mr. Frederick Palmer, president of the British Institution of Civil Engineers, to whom a hearty greeting was extended.

The annual ball lived up to the reputation made by its predecessors, and continues to be one of the best means of publicity of The Institute locally, as well as one of the city's most enjoyable social functions.

The managing committee regrets the loss of one of its valuable members, S. J. Fisher, M.E.I.C., who resigned in September on account of his removal from the city. His resignation was received with great regret.

The balance sheet shows that we had a successful year financially, and that our assets have been increased by approximately $100, so that we now have a working capital of $1,704.46.

Owing to deaths, transfers, removal of names from the lists, etc., our membership shows a decrease of 57. In this connection it is with deep regret that we report the loss through death of four members, namely, Dr. Martin Murphy, F. A. Wise, Colonel Georges Roy and A. A. Dion; two associate members, LeRoy T. Bowes and E. C. Hutchinson, and one Branch Affiliate, Thomas Shanks.

PROCEEDINGS AND PUBLICITY

During the year ten luncheons and eight evening meetings were held, and two visits were made to Chelsea and Farmer's Rapids as guests of the Fraser, Brace Engineering Company. The meetings were as follows:—

Jan. 14.—"**The Role of the Engineer in the Organization of Defence,**" by Major-General J. H. MacBrien, C.B., C.M.G., D.S.O.; luncheon meeting at Chateau Laurier.
Jan. 14.—Annual meeting, Daffodil tea rooms.
Jan. 19.—Annual ball at the Chateau Laurier.
Feb. 5.—"**Engineering in British Columbia,**" by Major Geo. A. Walkem, M.E.I.C., president of The Engineering Institute of Canada; luncheon meeting at the Chateau Laurier.
Feb. 11.—"**Some Great Men of Science and Their Books,**" by Dr. Leo E. Pariseau, Hotel Dieu, Montreal; evening meeting at the Victoria Memorial Museum.
Mar. 2.—"**The Canadian Arctic Expedition of 1925,**" by George P. Mackenzie, officer in charge of the expedition, Ottawa; evening meeting at the Victoria Memorial Museum.
Mar. 19.—"**International Co-operation in Geodetic Survey Work,**" by Major C. V. Hodgson, assistant chief, Division of Geodesy, U. S. Coast and Geodetic Survey, Washington; luncheon meeting at the Chateau Laurier.
Mar. 25.—Joint smoker with the Professional Institute of the Civil Service of Canada at the Chaudiere Golf Club.
Apr. 8.—"**Irrigation,**" by Grote Stirling, M.P.; luncheon meeting at the Chateau Laurier.
Apr. 15.—"**Electrons and the Vacuum Tube as Used in Radio Reception.**" The annual popular lecture by Major W. Arthur Steel, M.C., A.M.E.I.C.; evening meeting at the Victoria Memorial Museum.
Apr. 29.—"**Power Development at Chelsea,**" by A. H. White, M.E.I.C., chief engineer, International Paper Company, New York; luncheon meeting at the Chateau Laurier.
May 1.—Visit to Chelsea with the delegates of the International Electrotechnical Commission. Luncheon served at Chelsea through the courtesy of the Canadian International Paper Company and the Fraser-Brace Engineering Company.

May 7.—"**The Chicago Drainage Canal,**" by J. L. Busfield, M.E.I.C., Montreal; evening meeting in the Palm Room, Chateau Laurier.

Oct. 16.—Luncheon and trip to Chelsea and Farmer's Rapids. "**The Plant Under Construction,**" by A. H. White, M.E.I.C., chief engineer, International Paper Company, New York. Luncheon served through the courtesy of the Fraser, Brace Engineering Company at the Chelsea plant.

Oct. 28.—"**Duralumin,**" by N. F. Parkinson, A.M.E.I.C., deputy minister, Department of Soldiers' Civil Re-establishment; luncheon meeting at the Chateau Laurier.

Nov. 18.—"**Patents,**" by Alex. E. MacRae, A.M.E.I.C.; luncheon meeting at the Chateau Laurier.

Dec. 3.—"**The Treatment of Fuels,**" by Dr. C. H. Lander, director of the British Fuel Research Bureau; luncheon meeting at the Chateau Laurier.

Dec. 9.—"**Use of Thermit in Ice Control Work,**" by Dr. Howard T. Barnes, M.E.I.C., professor of physics at McGill University; evening meeting in the Palm Room, Chateau Laurier.

Dec. 16.—"**Canadian Coal for Canadian Consumers,**" by E. J. Garland, M.P.; luncheon meeting at the Chateau Laurier.

Dec. 29.—Address by Frederick Palmer, president of the Institution of Civil Engineers, Great Britain; luncheon meeting at the Chateau Laurier.

The attendance at the luncheon meetings averaged about 100, the largest attendance being at the complimentary luncheon to Mr. Frederick Palmer, when 177 were present. The attendance at the evening lectures averaged 200, the largest attendance being at Mr. MacKenzie's lecture, when 400 were present.

Membership

Owing to deaths, transfers, etc., during the year, there was a decrease in the total membership of the branch from 472 to 417, and in the corporate membership from 357 to 325.

The following table shows in detail the comparative figures of the branch membership for the years 1924, 1925 and 1926:—

	1924	1925	1926
Honorary Members	1	1	0
Members	112	113	112
Associate Members	232	244	213
Juniors	35	35	26
Students	31	34	22
Affiliates of Institute	6	8	7
Branch Affiliates	35	37	37
Totals	452	471	417

Rooms and Library

The branch library is still situated on the third floor of the Stephen building, where it is open for consultation by members under the same conditions that have prevailed.

Accessions to the library during the year consisted chiefly of government reports, the proceedings of the Institution of Civil Engineers, presented by F. H. Peters, M.E.I.C., and the proceedings of the Institution of Civil Engineers, provided by the librarian.

Advertising in the Journal

Commissions for advertising secured in the Journal during 1926 amounted to $26.15, which is equivalent to the rebates received from thirteen Associate Members.

Finances

The financial position of the branch continues to be very satisfactory, as may be seen from the attached statements of assets and liabilities, and of receipts and expenditures. Although these statements show that the bank balance is approximately $100.00 less than last year, the assets have increased by approximately the same amount.

The branch closed the year with a balance of $452.90 in the bank, $9.36 cash on hand, and $1,000 in Victory Bonds, a total balance of $1,462.26. In addition to this balance the branch has assets of $41.20 in rebates due from headquarters, and $201.00 in furniture, equipment, etc., making a total balance of $1,704.46. The financial standing of the branch from 1910 to the present state is shown on the accompanying chart.

The income for the last two years was: for 1925, $712.59, and for 1926, $1,043.81; the expenditure for 1925, $833.66, and for 1926, $1,186.41. The annual income of the branch from Victory Bonds is $52.50.

Officers for 1927

The annual meeting of the branch will be held in Ottawa on the 13th January, when the officers and members of the managing committee will be elected for the year 1927.

Financial Statement

Statement of Receipts and Expenditures
(For the year ending December 31st, 1926)

Receipts

Balance in bank, Jan. 1, 1926	$560.36	
Cash on hand, Jan. 1, 1926	4.50	
Interest on Victory Bonds	45.00	
Bank interest	11.80	
Rebates from headquarters, Nov. and Dec., 1925	55.40	
" " " Jan. to April, 1926	408.80	
" " " May to Aug., 1926	159.60	
" " " Sept. to Oct., 1926	53.60	
" " " Branch news, Jan. to April, 1926	16.33	
" " " Branch news, May to Aug., 1926	5.67	
" " " Branch news, Nov. to Dec., 1926	10.27	
" " " Advertising in Journal, 1925	107.19	
" " " Advertising in Journal, 1926	26.15	
Branch Affiliate fees	144.00	
Proceeds from sale of luncheon tickets	444.25	
		$2,052.92

Expenditures

Chateau Laurier—for luncheons	$707.00	
Daffodil Tea Rooms	33.50	
Printing, stationery, etc.	52.19	
Advertising	57.20	
Insurance	2.00	
Subscription to Engineering Journal	6.00	
Ball expenses	51.67	
Scrim's, etc., for flowers	56.03	
Ottawa Electric Railway—for buses	15.00	
W. G. Hughson & Sons—for bonds	309.27	
Sundries, lantern operator, entertainment, etc.	89.05	
Petty cash, postage, etc.	211.75	
Balance in bank, Dec. 31, 1926	452.90	
Balance cash on hand	9.36	
		$2,052.92

Statement of Assets and Liabilities
(For year ending December 31st, 1926)

Assets

Furniture (cost $200.00)	$ 80.00	
Library:		
Book cases (cost $105.50)	75.00	
Bound magazines (Nominal)	1.00	
Books "	25.00	
Rebates due from headquarters on 1926 fees	41.20	
Stationery and equipment	20.00	
Victory Bonds, due November 1, 1934	500.00	
" " " October 15, 1943	500.00	
Cash in bank	452.90	
Cash on hand	9.36	
		$1,704.46

Liabilities

Surplus	$1,704.46	
		$1,704.46

Audited and found correct.

K. M. Cameron, M.E.I.C. (*Auditor*).

Respectfully submitted,

J. D. Craig, M.E.I.C., *Chairman.*
F. C. C. Lynch, A.M.E.I.C., *Secretary-Treasurer.*

Peterborough Branch

The President and Council,—

The Executive of the Peterborough Branch begs to present to you the annual report on the activities of the branch as follows:—

Meetings

The annual general meeting was held on Thursday, May 13th, 1926, and was arranged as a general business meeting to be followed by a social evening.

The election of officers resulted as follows:—

Past-Chairman	A. L. Killaly, A.M.E.I.C.
Chairman	B. L. Barns, A.M.E.I.C.
Treasurer	A. B. Gates, A.M.E.I.C.
Secretary	W. E. Ross, A.M.E.I.C.
Executive	A. E. Caddy, M.E.I.C.
	R. C. Flitton, A.M.E.I.C.
	W. M. Cruthers, A.M.E.I.C.
	J. A. G. Goulet, M.E.I.C.
	P. Manning, A.M.E.I.C.

Fifteen regular meetings were held during the year, the papers were of high standard throughout and the attendance was, in general, satisfactory.

The papers presented were as follows:—

Jan. 14.—"**Trees,**" by H. J. Moore, lecturer in horticulture, Department of Agriculture, Ontario Provincial Government.

Feb. 4.—"**Power Factor Correction,**" by B. L. Barns, A.M.E.I.C., engineer, Canadian General Electric Company, Peterborough, Ontario.

Feb. 11.—"**Aviation and Modern Engineering Practice,**" by Wing-Commander E. W. Stedman, O.B.E., M.E.I.C.

Feb. 25.—"**Story of a Lump of Coal,**" by Geo. W. Allen, secretary-treasurer, Canadian Gas Association.

Mar. 11.—"**Manufacturing of Portland Cement,**" by H. S. Van Scoyoc, M.E.I.C., manager of Publicity, Canada Cement Company.

Mar. 25.—"**Installation and Operation of the North West Territories Radio Systems,**" by Major W. A. Steel, A.M.E.I.C., Department of National Defence, Ottawa.

Apr. 8.—"**The Chicago Drainage Canal,**" by J. L. Busfield, M.E.I.C., of Beaubien, Busfield and Company, Montreal.

Apr. 22.—"**Montreal-South Shore Bridge,**" by P. L. Pratley ,M.E.I.C., Monsarrat and Pratley, Montreal.

May 13.—Annual meeting.

Sept. 22.—Visit to Peterborough Sewage Disposal Plant.

Oct. 14.—"**Work of the Canadian Air Force,**" by Flt.-Lieut. T. A. Lawrence.

Oct. 16.—Dinner to Major Geo. A. Walkem, M.E.I.C.

Nov. 11.—"**Life of Sir William Van Horne,**" by Mr. W. Flavelle Lindsay.

Nov. 23.—Annual banquet.

Dec. 9.—"**Fundamentals of Correct Illumination for Factories and Office,**" by H. D. Burnett, manager, Lighting Service Department, Canadian General Electric Company.

In addition to the meetings listed above, the branch had an outing on May 29th, when about eighty members and friends journeyed by automobile to Young's Point, where the new lock, then under construction, was examined, after which the party proceeded to South Beach for supper, baseball, etc.

The average attendance at the meetings throughout the year has been forty.

MEMBERSHIP

The membership of the branch now stands as follows:—

Members	24
Associate Members	39
Juniors	11
Students	23
Affiliates, Branch Affiliates	14
Total	111

FINANCIAL STATEMENT

Receipts

Balance in bank Jan. 1st, 1926	$ 54.45	
Rebates on fees	168.75	
Journal news	12.38	
Dinner receipts	120.00	
Affiliate fees and subscriptions	56.00	
Bank interest	2.19	
		$413.77

Expenditures

Rent	$ 50.00	
Journal subscriptions	28.00	
Speakers and meetings	54.58	
Printing	74.69	
Secretarial expense	9.00	
Annual dinner expenses	107.55	
Postage, etc.	1.18	
Balance in bank	88.77	
		$413.77

A. B. GATES, A.M.E.I.C., *Treasurer.*

Respectfully submitted,

B. L. BARNS, A.M.E.I.C., *Chairman.*
W. E. ROSS, A.M.E.I.C., *Secretary.*

Quebec Branch

The President and Council,—

The Executive Committee of the Quebec Branch begs to present the following annual report on the work of the branch during the year 1926:—

MEMBERSHIP

	Resident	Non-Resident	Total
Members	18	1	19
Associate Members	57	11	68
Juniors	9	3	12
Students	11	1	12
Affiliates	1	..	1
Total membership			112

ANNUAL MEETING

The annual meeting of the Quebec Branch was held on May 25th, 1926, under the chairmanship of A. B. Normandin, A.M.E.I.C. The following officers were elected for the year 1926-1927:—

Honorary Chairman (for life)	A. R. Decary, M.E.I.C.
Chairman	A. B. Normandin, A.M.E.I.C.
Vice-Chairman	S. L. deCarteret, M.E.I.C.
Secretary-Treasurer	Louis Beaudry, A.M.E.I.C.
Executive Committee	T. E. Rousseau, M.E.I.C.
	Hector Cimon, A.M.E.I.C.
	L. C. Dupuis, A.M.E.I.C.
	Alex. Larivière, A.M.E.I.C.
Ex-officio	W. G. Mitchell, M.E.I.C.

MEETINGS

The Executive of the Quebec Branch has held meetings regularly during the year 1926.

The monthly luncheons and evening meetings of the branch were held regularly at the Chateau Frontenac and at the City Hall from January to June.

The Quebec Branch had the pleasure during the year of having a visit from Major Geo. A. Walkem, M.E.I.C., president of The Institute.

It has been our pleasure to have frequent opportunities of welcoming outside members of our Institute and also prominent men in public life at our different luncheons and evening meetings. All meetings were attended by practically the entire membership of the branch, and very good publicity of the activities of the branch was given through the press.

All questions submitted by the Council of The Institute have been studied, discussed and transacted.

Our branch has followed with interest the Institute deliberations and has devoted its full energy to all matters aiming to the protection and promotion of the interest of The Institute and its members.

Our special committee has followed closely, studied seriously and made as complete report as possible on all applications for membership which have been referred to this branch and the necessary recommendations have been made to the Council and The Institute.

MEETINGS

The following addresses were made at our different luncheons and evening meetings:—

"**Power Development in the Province of Quebec,**" by Fraser S. Keith, M.E.I.C., manager, Department of Development, Shawinigan Water and Power Company.

"**The Engineer and the Commission of Public Services,**" by F. Chas. Laberge, M.E.I.C., member of the Commission of Public Services.

"**The Telephone,**" by G. M. Hudson, A.M.E.I.C., division plant engineer, Bell Telephone Company of Canada, Limited.

"**Transportation,**" by R. A. C. Henry, M.E.I.C., director, Bureau of Economics, Canadian National Railways.

"**Water Diversion from the Great Lakes by the Chicago Drainage Canal,**" by de Gaspé Beaubien, M.E.I.C., consulting engineer, Montreal.

"**The Quebec Harbour,**" by Brig.-Gen. T. L. Tremblay, C.M.G., D.S.O., A.M.E.I.C., chief engineer, Quebec Harbour Commission.

FINANCIAL STATEMENT

Revenue

Cash in bank, Jan. 1st, 1926	$ 78.87	
Bank interest	2.49	
Rebates from headquarters:—Members' fees	259.80	
Branch news	14.08	
		$355.24

Expenditures

Printing, stamps, etc.	$ 48.75	
Expenses of meetings	65.00	
Postal box	6.00	
Miscellaneous	125.00	
		$244.75
Balance on hand, January 1st, 1927		$110.49

Respectfully submitted,

A. B. Normandin, A.M.E.I.C., *Chairman.*
Louis Beaudry, A.M.E.I.C., *Secretary-Treasurer.*

Au Président et au Conseil,—

Le conseil de la section de Québec a l'honneur de vous soumettre son rapport annuel pour l'année 1926 comme suit:—

Rôle des Membres

	Résidents	Non résidents	Total
Membres	18	1	19
Membres associés	57	11	68
Membres juniors	9	3	12
Membres étudiants	11	1	12
Membres affiliés	1	..	1
Total des membres			112

Assemblée Annuelle

L'assemblée annuelle de la section de Québec a été tenue le 25 mai 1926, sous la présidence de A. B. Normandin, A.M.E.I.C. Les officiers dont les noms suivent ont été élus pour l'année 1926-1927:—

Président Honoraire à vie	A. R. Décary, M.E.I.C.
Président	A. B. Normandin, A.M.E.I.C.
Vice-Président	S. L. deCarteret, A.M.E.I.C.
Secrétaire-Trésorier	Louis Beaudry, A.M.E.I.C.
Conseillers	T. E. Rousseau, M.E.I.C.
	Hector Cimon, A.M.E.I.C.
	L. C. Dupuis, A.M.E.I.C.
	Alex. Larivière, A.M.E.I.C.
Ex-officio	W. G. Mitchell, M.E.I.C.

Assemblées

Le conseil de la section de Québec a tenu ses assemblées régulièrement durant l'année 1926.

Les désjeuners et assemblées du soir de chaque mois ont été tenues régulièrement au Château Frontenac et à l'Hôtel de Ville de Québec, à partir du mois de janvier jusq'au mois de juin.

La section de Québec a eu le plaisir, durant l'année, d'avoir la visite du Major Geo. A. Walkem, M.E.I.C., président de l'Institut.

A nos différents déjeuners et assemblées du soir, nous avons eu fréquemment l'occasion de compter parmi nous des membres de l'Institute étrangers à notre section, ainsi que des personnages de marque dans la vie publique. Toutes nos assemblées ont réuni la presque totalité des membres de notre branche, et la presse a toujours eu l'amabilité de donner de très bons comptes-rendus de nos travaux.

Toutes les questions soumises par le Conseil Général à la section de Québec ont été étudiées, discutées et transigées.

Notre section a suivi avec intérêt, les travaux de l'Institut et a prêté son plein concours à toutes les questions ayant pour but de protéger et de promouvoir les intérêts de l'Institut et de ses membres.

Notre comité spécial s'est occupé de surveiller, de faire une étude sérieuse et de faire un rapport aussi complet que possible sur toutes les demandes d'admission qui ont été référée à notre section, et les recommendations nécessaires ont été faites au Conseil Général de l'Institut qui a bien voulu en tenir compte.

Causeries

Les causeries suivantes ont été faites à nos différentes assemblées du soir et des déjeuners:—

"**Le développement des pouvoirs hydrauliques dans la province de Québec,**" par Fraser S. Keith, M.E.I.C., de la Shawinigan Water and Power Company.

"**L'ingénieur et la Commission des Services Publics,**" par F. Chas. Laberge, M.E.I.C., membre de la Commission des Services Publics.

"**Le téléphone,**" par G. M. Hudson, A.M.E.I.C., de la Bell Téléphone Companie de Canada.

"**Le transport,**" par R. A. C. Henry, M.E.I.C., directeur du bureau des économies de la Canadian National Railway.

"**Le détournement des eaux des grands lacs par le canal de Chicago,**" par deGaspé Beaubien, M.E.I.C., ingénieur conseil de Montréal.

"**Le port de Québec,**" par le brigadier-général T. L. Tremblay, C.M.G., D.S.O., A.M.E.I.C., ingénieur en chef de la Commission du Havre de Québec.

Etat Financier

Recettes

Caisse au 1er janvier 1926	$ 78.87	
Intérêt sur compte de banque	2.49	
Remise du bureau chef:—Cotisations des membres.	259.80	
Nouvelles pour Journal	14.08	
		$355.24

Dépenses

Impressions, timbres, etc.	65.00	
Dépenses pour assemblées	65.00	
Casier postal	6.00	
Divers	125.00	
		$244.75
Solde au 1st janvier 1927		$110.49

Respectueusement soumis,

A. B. Normandin, A.M.E.I.C., *Président.*
Louis Beaudry, A.M.E.I.C., *Secrétaire-Trésorier.*

Saint John Branch

The President and Council,—

Herewith is submitted the ninth annual report of the Saint John Branch for the year ending December 31st, 1926.

Meetings

The executive met seven times during the year. The branch held ten meetings. One of these was a joint luncheon, under the auspices of the branch, with the Women's and Men's Canadian Clubs of Saint John. The branch held a joint dinner with the Association of Professional Engineers of the Province of New Brunswick at the time of the annual meeting of the Association. The annual meeting of the branch was held following a dinner. For the first time since its formation the branch held a summer picnic, which will be repeated. The members were present with the Men's Canadian Club at a luncheon meeting held by the Women's Canadian Club.

Members of the branch have shown an interest in, and have derived benefit from the general work of the Institute. A visit during the year from R. J. Durley, M.E.I.C., general secretary of the Institute, was appreciated; such visits from Institute officers are recognized as a splendid means of keeping the branch members in touch with Institute headquarters. Three members of the branch attended the annual meeting in Toronto during January and seven members visited Sydney for the Maritime Professional meeting in August.

The branch held a diversified programme of meetings during the year. Good interest in the meetings has been shown by members, and also by the general public, who are made welcome. Ladies are usually present at branch meetings and find the addresses of interest.

The branch has had good support from its various committees. The press of Saint John has generously published accounts of the various activities of the branch.

The branch has co-operated with other branches in the Maritime Provinces in having an interchange of speakers. Addresses have also been given before the branch by speakers from outside the Maritime Provinces. It is submitted that an interchange of speakers and papers between branches be encouraged as widely as possible.

Meetings—1926

Jan. 5.—Joint meeting of Saint John Branch and Men's and Women's Canadian Clubs. "**Canadian Arctic Expedition, 1925,**" by George P. MacKenzie.

Jan. 21.—"**Radio Direction Finding,**" by Lt.-Commander C. P. Edwards, O.B.E., A.M.E.I.C. Joint dinner with Association of Professional Engineers of New Brunswick.

Feb. 20.—"**The Interconnection of High and Low Pressure Turbines,**" by J. D. Garey, A.M.E.I.C.

Mar. 5.—"**The Manufacture of Cement,**" by H. S. Van Scoyoc, M.E.I.C.

Mar. 22.—"**What's the Matter With Europe?**" by D. Thomas Curtin. Joint meeting, Women's Canadian Club, Men's Canadian Club, and Saint John Branch, (under auspices of Women's Canadian Club).

Apr. 21.—"**Photography in Science, Industry and Medicine,**" by Prof. E. L. Harvey, M.A.

May 5.—Annual meeting.

Aug. 12.—Picnic at Belyea's Point. "**Institute Affairs,**" by R. J. Durley, M.E.I.C.

Oct. 27.—"**Coal and Other Fuels Derived from It,**" by K. L. Dawson, A.M.E.I.C.
Nov. 18.—"**The Architectural Design of Buildings,**" by W. W. Alward, A.R.I.B.A.
Dec. 9.—"**Industrial Lighting,**" by S. C. Webb, A.M.E.I.C.

MEMBERSHIP

The branch territory comprises the nine western counties of New Brunswick. The membership on December 31, 1926, is as follows:—

Grade	Branch Residents	Branch Non-residents	Total
Members	13	10	23
Associate Members	27	12	39
Juniors	5	3	8
Students	3	2	5
Affiliates	2	..	2
Branch Affiliates	2	..	2
Total	52	27	79

Total at end of 1925, 90; total at end of 1926, 79; net loss, 11.

FINANCIAL STATEMENT

Receipts

Balance in bank Dec. 31st, 1925	$ 46.43	
Refund Maritime Professional meeting, 1925	25.00	
Rebates of members' fees	187.50	
Branch news	32.51	
Branch Affiliates, dues and Journal subscription	12.00	
Canadian Club joint dinner, rebate payment	1.50	
		$304.94

Expenses

Hall and meeting	$ 46.65	
Printing	25.22	
Maritime Professional meeting, 1926	25.15	
Stenography	15.00	
Branch Affiliates, Journal subscriptions	4.00	
Copies of standard specifications	1.50	
Disbursements by secretary	65.11	
Balance in bank Dec. 31, 1926	122.31	
		$304.94

Assets

Balance in bank Dec. 31, 1926	$122.31	
Rebates of members' fees outstanding	30.60	
		$152.91

Liabilities

Outstanding accounts	$ 40.67	
Surplus on Dec. 31, 1926	112.24	
		$152.91

Respectfully submitted,

A. R. CROOKSHANK, M.E.I.C., *Chairman.*
W. J. JOHNSTON, A.M.E.I.C., *Secretary-Treasurer.*

Saguenay Branch

The President and Council,—

On behalf of the Executive Committee we beg to submit the annual report of the Saguenay Branch for the year 1926.

The Saguenay Branch has had the pleasure of entertaining the president and the immediate past-president of The Institute during the past year. Early in the year Dr. Arthur Surveyer, M.E.I.C., and in October last, Major Geo. A. Walkem, M.E.I.C., were in the lake St. John district. Dr. Surveyer's trip was of a personal character, but Major Walkem was on an official tour. Although no regular meeting was held, an opportunity was afforded a number of prominent members to meet him informally at Chicoutimi, Arvida, Kenogami, Isle Maligne and Riverbend, in connection with which a motor outing had been organized.

R. J. Durley, M.E.I.C., general secretary of The Institute, accompanied Major Walkem. This is Mr. Durley's first visit to our branch, and it is hoped that he will again visit us with our next president, or more often if possible.

During the summer months an excursion of the Montreal Branch visited our territory. N. E. D. Sheppard, A.M.E.I.C., assistant secretary, and Fraser S. Keith, M.E.I.C., former general secretary, were among those who were welcomed by us on that occasion.

OFFICERS

The election of officers resulted as follows:—

Chairman .... Edouard Lavoie, M.E.I.C.
Vice-Chairman .... C. E. Legris, A.M.E.I.C.
Secretary-Treasurer ...... Burroughs Pelletier, A.M.E.I.C.
Executive .... J. L. Delisle, A.M.E.I.C., (1 year)
H. G. Cochrane, A.M.E.I.C. (2 years)
C. C. Lindsay, A.M.E.I.C. (2 ")
C. N. Shanly, M.E.I.C. (ex-officio)

MEMBERSHIP

The membership of the branch is as follows:—

Members	3
Associate Members	26
Juniors	9
Students	21
Total	59

Although the membership shows an increase, we have to record with regret the departure of several of our most esteemed members from Kenogami to Quebec.

FINANCIAL STATEMENT

(As at January 1st, 1927)

Receipts

Balance on hand from last report	$ 57.34	
Rebates from headquarters	103.35	
		$160.69

Disbursements

Expenses re annual elections	$ 16.34	
Postage, stationery, telegrams, exchange	4.21	
Expenses re Montreal Branch visit	66.32	
Balance on hand	73.82	
		$160.69

Respectfully submitted,

EDOUARD LAVOIE, M.E.I.C., *Chairman.*
BURROUGHS PELLETIER, A.M.E.I.C., *Secretary-Treasurer.*

Saskatchewan Branch

The President and Council,—

On behalf of the Executive Committee we beg to submit the following report concerning the activities of the Saskatchewan Branch for the calendar year 1926.

EXECUTIVE COMMITTEE

The present executive was elected on March 11th at the branch annual meeting, and with those continuing in office is as follows:—

Chairman .... W. H. Greene, M.E.I.C., Moose Jaw.
Vice-Chairman .... M. B. Weekes, M.E.I.C., Regina.
Secretary-Treasurer .... R. W. E. Loucks, A.M.E.I.C., Regina.
Executive ... (2 years) .. J. W. D. Farrell, A.M.E.I.C., Regina.
A. M. Macgillivray, A.M.E.I.C., Saskatoon.
P. C. Perry, A.M.E.I.C., Regina.
(1 year) .. J. M. Campbell, A.M.E.I.C., Moose Jaw.
R. H. Murray, A.M.E.I.C., Regina
D. A. R. McCannel, A.M.E.I.C., Regina.
R. N. Blackburn, M.E.I.C., Regina. (Past Chairman).
H. R. Mackenzie, A.M.E.I.C., Regina. (Councillor).

COMMITTEES

Chairmen of the standing committees are:—

Papers and Library .... D. A. R. McCannel, A.M.E.I.C.
Legislation .... R. N. Blackburn, M.E.I.C.
Nominating .... L. A. Thornton, M.E.I.C.
Attendance .... D. W. Houston, A.M.E.I.C.
T. McGuinness, A.M.E.I.C.
Publicity .... J. W. D. Farrell, A.M.E.I.C.
Meetings .... R. W. Allen, A.M.E.I.C.

The Saskatchewan Branch representative on the Nominating Committee of the Institute is R. N. Blackburn, M.E.I.C.

MEMBERSHIP

The membership of the branch has continued with the usual fluctuations due to transfers, etc.

The present membership of the branch is:—

	Branch Residents	Branch Non-residents	Total
Members	6	11	17
Associate Members	39	32	71
Juniors	3	3	6
Students	1	4	5
Affiliates	1	1	2
Branch Affiliates	5	0	5
Total	55	51	106

MEETINGS

The executive held seven meetings for the transaction of branch affairs. There were six regular meetings of the branch and one special summer meeting. The summer meeting was held in camp in River Park, at Estevan, Sask., on July 8th, 9th and 10th, and was attended by our general secretary, R. J. Durley, M.E.I.C., and by other notable guests. It was a joint meeting in conjunction with the Saskatchewan section of the American Institute of Electrical Engineers and the Southern Saskatchewan section of the Canadian Institute of Mining and Metallurgy.

Special matters referred to the executive by the general secretary, pertaining to Students' prizes, recruiting of new members, co-operation with Boards of Trade, etc., were considered and suitable action taken thereon.

The regular meetings have been well attended and considerable interest and enthusiasm shown by the officers and members. They were, in each case, preceded by a dinner. These meetings have been scheduled to fit in with the meetings of the Saskatchewan section of the A.I.E.E. and the branch has endeavoured to co-operate in every way with this sister organization.

PROGRAMME

The programme for the year was as follows:—

Jan. 20.—"Transportation Night." **"The Miracle of Transportation,"** by F. T. Lewis, division engineer, C.P.R.; **"The Street Railway Today and Tomorrow,"** by D. W. Houston, A.M.E.I.C.; **"Railway History in Canada,"** by P. C. Perry, A.M.E.I.C.

Feb. 18.—"Highways and Drainage Night" **"Progress in Construction of Provincial Highways,"** by H. R. Mackenzie, A.M.E.I.C.; **"Bridges and Bridge Sites,"** by D. C. M. Davies, A.M.E.I.C.; **"Drainage Development in Saskatchewan,"** by M. B. Weekes, M.E.I.C.

Mar. 11.—Ninth annual meeting. Reports of committees, election of officers, address by retiring chairman, R. N. Blackburn, M.E.I.C., banquet, toast list and other entertainment.

Oct. 20.—Meeting in Moose Jaw. **"Present Sewer and Water Conditions in Saskatchewan,"** by R. H. Murray, A.M.E.I.C.; **"Growth of Industrial Power in Saskatchewan,"** by J. D. Peters, A.M.E.I.C.; Presentation of Badges to Past Chairmen, J. R. C. Macredie, M.E.I.C., and G. D. Mackie, M.E.I.C.

Nov. 19.—**"Recent Advances in the Engineering Side of Building Construction,"** by J. H. Puntin, A.M.E.I.C.; **"Mineral Deposits of Southern Saskatchewan, their Location, Uses and the Possibilities for Development,"** by W. H. Hastings, B.SC., engineer with the Bureau of Labour and Industries, province of Saskatchewan; **"Outdoor Signs,"** by Stewart Young, A.M.E.I.C.

Dec. 10.—"Round the World Night." Addresses on the outstanding engineering achievements of ten countries as follows:— **"Africa,"** by J. C. Meade, A.M.E.I.C.; **"China,"** by J. G. Schaeffer, S.E.I.C.; **"France,"** by Capt. G. R. Chetwynd, A.M.E.I.C.; **"Germany,"** by P. R. Genders, A.M.E.I.C.; **"India,"** by D. D. Low, Jr.E.I.C.; **"Italy,"** by G. G. Fitzgerald, A.M.E.I.C.; **"Japan,"** by J. B. Parker, A.M.E.I.C.; **"Norway and Sweden,"** by Edwin Markham, A.M.E.I.C.; **"Russia,"** by W. T. E. Smith, BRANCH AFFILIATE; **"South America,"** by T. McGuinness, A.M.E.I.C.

July 8, 9 and 10.—Summer meeting at Estevan, Sask. **"Electrical Development of Southern Saskatchewan,"** by S. R. Parker, A.M.E.I.C.; **"Industrial Development of Southern Saskatchewan,"** by W. H. Greene, M.E.I.C.; **"Notes on Mining Claims and Mineral Prospects in the Mineral Belt North of The Pas, Manitoba,"** by W. T. Thompson, M.E.I.C.; **"The Preservative Treatment of Wood,"** by R. D. Prettie, of the Alberta Wood Preserving Co., Calgary, Alta.; **"Rural Electrification,"** by C. A. Clendening, A.M.E.I.C., Manitoba power commissioner.

SCHOLARSHIP

The annual scholarship of $50.00 offered by the branch to the most deserving student in the graduating class in engineering of the University of Saskatchewan, was awarded to Mr. G. N. Munro.

FINANCIAL STATEMENT

Revenue

Balance from 1925	$102.91	
Headquarters rebates	221.40	
Branch dues	57.00	
Meetings	178.00	
Sundries, branch news, etc.	84.64	
		$643.95

Expenditure

Meetings	$185.30	
Stationery, notices, etc.	54.13	
Scholarship	50.00	
Honorariums	150.00	
Sundries	14.35	
Cash in bank	157.77	
Cash on hand	32.40	
		$643.95

Respectfully submitted,

R. W. E. LOUCKS, A.M.E.I.C., *Secretary-Treasurer.*
W. HARVEY GREENE, M.E.I.C., *Chairman.*

Sault Ste. Marie Branch

The President and Council,—

The attendance at the meetings for the year averaged twenty-seven, and all the meetings except one were preceded by a dinner at the Y.W.C.A. rooms, Queen street east. The attendance showed a marked improvement over 1925, and averaged fifty per cent of our resident members.

It is unfortunate that our district covers such an extended area, as our branch district members find it impossible to be at the meetings.

All the members greatly appreciated the efforts put forward by the Papers and Publicity Committee and the Entertainment Committee in providing most interesting papers. The only inspection trip was one through the Provincial Government hangar. About forty of our members took advantage of this privilege.

The entertaining of Major Geo. A. Walkem, M.E.I.C., president of The Institute, on February 22nd, and of R. J. Durley, M.E.I.C., general secretary of The Institute, on July 15th, were two very interesting events this year.

The regular meeetings were held on the last Friday of each month, except the special meetings held in February, March, June and July, and the papers given and the inspection trips made were as follows:—

Jan. 29.—**"Canadian Engineering and Architectural Problems,"** by Mr. James Govan, R.A.I.C., consulting architect of Toronto.

Feb. 22.—A special meeting was held to welcome Major Geo. A. Walkem, M.E.I.C., president of The Institute.

Mar. 5.—**"The Manufacture of Artificial Silk,"** by Mr. A. D. Hone, principal of the Technical school.

Mar. 26.—**"Wind Measurements,"** by Carl Stenbol, M.E.I.C., of the Algoma Steel Corporation.

Apr. 30.—Inspection trip through the Provincial Government hangar under the guidance of Major Thompson and Major Clayton.

June 1.—**"Mining Conditions as Found in South Africa,"** by T. F. Sutherland, chief inspector of mines for the Province of Ontario, assisted by G. C. Bateman, secretary of the Ontario Mining Association.

June 25.—**"Methods Employed at the Fish Hatchery,"** by Mr. C. Hartman, superintendent of the Provincial Government hatchery in the Sault.

July 15.—A special luncheon and meeting was held to welcome R. J. Durley, M.E.I.C., general secretary of The Institute.

Sept. 24.—The first regular meeting after the holiday. As no paper was available a general discussion was carried on.

Oct. 29.—**"The Chicago Drainage Canal,"** by R. S. McCormick, M.E.I.C., general manager and chief engineer of the Algoma Central and Hudson Bay Railway of the Sault.

Nov. 25.—**"The Manufacture and Composition of Alloy Steel,"** by Mr. H. B. Greenstead, engineer of tests for the Algoma Steel Corporation.

Dec. 17.—Annual meeting; reports of all committees; election of officers for 1927; address by retiring chairman C. H. Speer, M.E.I.C., also inspection trip through the plant of the Sault Daily Star under the guidance of Mr. J. W. Curran.

PRESENT MEMBERSHIP

	Branch Residents	Branch Non-residents	Total
Members	11	12	23
Associate Members	11	35	46
Juniors	9	5	14
Students	3	13	16
Affiliates	1	..	1
Branch Affiliates	17	..	17
Total	52	65	117

This is a decrease of four members as shown by the 1925 report. Conditions are about the same industrially throughout this district as last year. There are three or four applications for admission and transfer pending.

We would like to express our appreciation to Mr. Durley and his staff at headquarters for the assistance rendered in keeping track of the district members and in helping keep our membership list corrected to date.

Financial Statement

Receipts

Balance from 1925	$ 37.85	
Income from rebates	202.65	
Income from advertising	78.00	
Income from Branch news	45.27	
Affiliate fees	44.00	
Journal subscriptions	18.00	
Dinners	113.25	
		$539.02

Expenditures

Postage and cards	$ 29.00	
Printing	62.02	
Gratuities and donations	65.13	
Stenographer	25.00	
Telegrams	.63	
Secretary's honorarium for 1925 and 1926	50.00	
Dinners and entertainment	179.85	
Journal subscriptions	16.15	
Sundries	9.50	
		$437.28
Balance in current account		$101.74
Balance in savings account		105.07
Total balance		$206.81
Outstanding Branch Affiliate fees	$ 33.00	

Respectfully submitted,

C. H. Speer, M.E.I.C., *Chairman.*
A. H. Russell, A.M.E.I.C., *Secretary-Treasurer.*

Toronto Branch

The President and Council,—

The Executive Committee of the Toronto Branch respectfully submits the following report for the calendar year 1926:—

During this period the present Executive was elected in March at the branch annual meeting.

Executive Committee

January to March, 1926		March to December, 1926
T. R. Loudon, A.M.E.I.C.	Chair.	J. G. R. Wainwright, A.M.E.I.C.
J. G. R. Wainwright, A.M.E.I.C.	Vice-C.	R. B. Young, M.E.I.C.
C. B. Ferris, A.M.E.I.C.	Sec.-Trea.	J. W. Falkner, A.M.E.I.C.
R. W. Angus, M.E.I.C.	Exec'tive	A. E. K. Bunnell, M.E.I.C.
E. T. J. Brandon, A.M.E.I.C.		H. W. Tate, A.M.E.I.C.
R. B. Young, M.E.I.C.		L.W.Wynne-Roberts, A.M.E.I.C.
J. A. Knight, A.M.E.I.C.		A. T. C. McMaster, M.E.I.C.
A. C. Oxley, A.M.E.I.C.		I. H. Nevitt, M.E.I.C.
L.W.Wynne-Roberts, A.M.E.I.C.		J. A. Knight, A.M.E.I.C.
H. K. Wicksteed, M.E.I.C.	*Ex-officio*	T. R. Loudon, M.E.I.C.
G. T. Clark, A.M.E.I.C.		E. G. Hewson, M.E.I.C.
E. G. Hewson, M.E.I.C.		J. M. Oxley, M.E.I.C.
J. M. Oxley, M.E.I.C.		H. K. Wicksteed, M.E.I.C.
J. H. Curzon, A.M.E.I.C.		C. B. Ferris, A.M.E.I.C.

Standing Committees

The standing committees with the chairmen of each are:—

Programme	J. G. R. Wainwright, A.M.E.I.C.
	H. W. Tate, A.M.E.I.C.
Finance	R. B. Young, M.E.I.C.
Publicity—March to October	S. G. Talman, A.M.E.I.C.
October to date	James Hyslop, M.E.I.C.
Library	A. T. C. McMaster, M.E.I.C.
Attendance	L. W. Wynne-Roberts, A.M.E.I.C.
Student Relations	W. B. Dunbar, A.M.E.I.C.
Membership	E. T. J. Brandon, A.M.E.I.C.

The Toronto Branch representative on the Nominating Committee of The Institute is R. B. Young, M.E.I.C., who was elected by the Executive for this office during 1927.

Annual and Professional Meeting of the Institute, 1926

The Annual General and General Professional Meeting of The Institute was held in Toronto on January 27th, 28th and 29th, 1926. The Annual Meeting Committee consisted of the Executive Committee of the Toronto Branch together with the following members, under the chairmanship of Professor C. R. Young, M.E.I.C.:—

Chairman	C. R. Young, M.E.I.C.
Vice-Chairman and Papers	W. P. Dobson, M.E.I.C.
Secretary	L. W. Wynne-Roberts, A.M.E.I.C.
Finance	W. E. Douglas, A.M.E.I.C.
Dinner	Col. H. J. Lamb, M.E.I.C.
Entertainment	B. N. Simpson
Service	H. W. Tate, A.M.E.I.C.
Accommodation	J. B. Carswell, A.M.E.I.C.
Publicity	C. A. Meadows, A.M.E.I.C.
Reception	R. O. Wynne-Roberts, M.E.I.C.
Convener of Ladies' Committee	Mrs. C. H. Mitchell

Meetings

The branch Executive held thirteen meetings for the transaction of branch affairs. There were thirteen branch general meetings. Of these, three were luncheon-meetings, which were held down town at 12.30 noon on the first Thursday of the month, from time to time, and were well attended.

The January, February and March luncheon-meetings were addressed respectively by R. A. C. Henry, M.E.I.C., of the Canadian National Railway; George Hogarth, M.E.I.C., deputy minister of Public Works, and Geo. H. Ross, finance commissioner of Toronto.

For the branch general meetings it has been the desire and endeavour of the branch executive to have papers of as great an educational value as possible, one of the aims being to give the men entering the profession some information as to what phases of engineering are represented in our large organizations. The average attendance has been about seventy, the attendance on March 18th, when J. L. Busfield, M.E.I.C., addressed the branch on the "Chicago Drainage Canal," being approximately two hundred. It was decided by the branch Executive in October, after careful consideration, that for the coming season two regular evening meetings should be held each month, with additional luncheon meetings when speakers were available.

The branch was greatly pleased to welcome R. J. Durley, M.E.I.C., general secretary of The Institute, on his annual visit to the branch at the executive and regular meetings on November 25th, and thoroughly appreciated his visit.

The programme for the year has been the following:—

Jan. 7.—Luncheon-meeting. "**The Motor Vehicle vs. Other Forms of Transportation,**" by R. A. C. Henry, M.E.I.C.

Jan. 21.—"**The Work of the Ontario Experimental Station in Promoting the Art of Sewage Disposal,**" by F. A. Dallyn, M.E.I.C., and A. V. DeLaporte, M.E.I.C.

Jan. 27, 28 and 29.—Annual General and General Professional Meeting of the Engineering Institute, King Edward Hotel, Toronto.

Feb. 4.—Luncheon meeting to George Hogarth, M.E.I.C., deputy minister of Public Works, Ontario.

Feb. 11.—"**Engineering Specifications,**" by S. E. Craig.

Feb. 18.—"**The Economic and Engineering Situation in Canada,**" by Brig.-General C. H. Mitchell, C.B., C.M.G., D.S.O., M.E.I.C.

Feb. 25.—"**The Conservation of Rainfall in Southern India,**" by G. W. Winckler, M.E.I.C.

Mar. 4.—Luncheon-meeting. "**Civic Finance,**" by Geo. H. Ross, finance commissioner, city of Toronto.

Mar. 18.—"**The Chicago Drainage Canal,**" by J. L. Busfield, M.E.I.C.

Mar. 25.—Branch annual meeting and elections.

Oct. 28.—"**The Functioning of the Way Department of the Toronto Transportation Commission,**" by H. W. Tate, A.M.E.I.C.

Nov. 11.—"**Power Distribution Problems of the Toronto Transportation Commission,**" by J. F. Neild, M.A.I.E.E.

Nov. 25.—"**The Construction and Maintenance of Equipment on a Modern Electric Railway System,**" by W. R. McRae, M.A.I.E.E.

Dec. 16.—"**The Story of Compressed Air,**" by G. R. Southee.

Membership

The membership of the branch has continued with the usual fluctuations due to transfers, etc.

The total at December 31st, 1926, was:—

	Branch Residents	Branch Non-Residents	Total
Members	133	4	137
Associate Members	237	16	253
Juniors	46	1	47
Students	74	6	80
Affiliates	4	..	4
Branch Affiliates	2	..	2
Total	496	27	523

Financial Statement—For the Calendar Year 1926

Revenue

Balance as at Jan. 1st, 1926	$ 331.44	
Rebates and branch news	785.85	
Annual Meeting Committee surplus	615.86	
Branch Affiliates	40.00	
Refund from Engineers' Club	21.80	
Bank interest to Dec. 31st, 1926	16.65	
		$1,811.60

Expenditure

Advertising and printing	$ 308.25	
Rent of room	77.55	
Lecturers' expenses	74.50	
Music at luncheon-meetings	15.00	
Entertainment at Hart House meeting	25.90	
Annual Meeting—extra expenses and adjustment with headquarters	123.15	
Stenography, postage, cartage, etc.	57.20	
Flowers for Sir Alex. Bertram's funeral	6.00	
Insurance	13.93	
Subscriptions to the "Engineering Journal"	8.00	
Secretary's honorarium	100.00	
Balance as at Dec. 31st, 1926	1,002.12	
Total		$1,811.60

Respectfully submitted,

J. G. R. Wainwright, a.m.e.i.c., *Chairman.*
J. W. Falkner, a.m.e.i.c., *Secretary-Treasurer.*

Vancouver Branch

The President and Council,—

We have the honour to report on the affairs of the Vancouver Branch, for the year 1926, as follows:—

General

The policy of previous years of co-operating with the Association of Professional Engineers of British Columbia, and the Vancouver section of the American Institute of Electrical Engineers, and other Societies, has been continued through the year. The scope of the papers given before the branch has been broadened, with resulting increase of interest. It has been noted that it will take some years before the full effect of this broadening of the scope of the papers is fully appreciated.

The following meetings have been held by the branch during the year:—

Mar. 2.—In conjunction with the Vancouver section of the American Institute of Electrical Engineers, a moving picture film on:—"**From Mine to Consumer.**"

Mar. 13.—A special dinner of welcome was given to Major Geo. A Walkem, m.l.a., m.e.i.c., on account of his election to the presidency of The Institute.

Apr. 22.—"**Cloud Phenomena and the Upper Atmosphere,**" by Mr. E. Sherman.

May 26.—"**The Relation of the Profession to the University.**" Dean R. W. Brock, m.e.i.c., of the University of British Columbia.

June 3.—A record attendance of the branch and members of the Association of Professional Engineers, who visited Alouette lake as guests of the B. C. Electric Railway Company.

June 8.—"**The Generation of Steam at Critical Temperatures and at 3,200 Pounds Per Square Inch,**" by Dr. Mark Benson.

June 29.—A general meeting to meet R. J. Durley, m.e.i.c., the general secretary of The Institute.

Aug. 28.—A special trip to the B. C. pier of the Canadian Pacific Railway Company was held in conjunction with the other societies of the city, and a party of engineers from Bellingham, Wash., was entertained.

Sept. 11.—In co-operation with the Vancouver section of the American Institute of Electrical Engineers, a record all-day trip was made of inspection to the Britannia mine.

Oct. 6.—"**The Education of the Engineer,**" by Professor W. E. Duckering. This was the first of a series of addresses on the subject.

Oct. 13.—"**Changing Aspects of Mining,**" by Professor J. M. Turnbull.

Oct. 20.—Mr. Frank Sawford, together with J. Muirhead, m.e.i.c., discussed with the members "**The Professional Engineer Movement.**"

Oct. 29.—"**Seismic Disturbances and Their Effect on Buildings,**" by Mr. F. Napier Denison, superintendent of the Dominion Meteorological Service, British Columbia Division.

Nov. 3.—"**The Influence of the Medical Profession on the Education of a Medical Student,**" by Dr. H. W. Hill.

Nov. 10.—"**The Geology of Britannia Mines,**" by Dr. S. J. Schofield.

Nov. 24.—"**The Reproducing of Engineering Drawings,**" by H. B. Muckleston, m.e.i.c.

Dec. 8.—"**The Principles of Education and Their Bearing on Vocational Selection.**" By Dr. G. M. Weir.

A further eighteen meetings have been arranged for the remainder of the winter session.

Executive Committee Meetings

The Executive Committee held nine meetings during 1926, and dealt with a number of very important and interesting problems of great moment to the profession. Chief of these was an effort to create closer co-operation between engineers of the public services and the various associations administering engineering acts throughout the Dominion. This was undertaken at the request of the Council of the Association of Professional Engineers.

Membership

Grade	Dec. 13th, 1926	Dec. 17th, 1925	Dec. 18th, 1924
Branch Residents:—			
Members	56	60	61
Associate Members	73	90	87
Juniors	9	7	6
Students	28	42	40
Affiliates	0	0	0
	166	199	194
Branch Non-Residents:—			
Members	15	20	19
Associate Members	51	59	55
Juniors	8	12	10
Students	7	9	9
Affiliates	0	1	1
	81	101	94

Branch Elections

In connection with the election of branch officers, sixty-six ballots out of a total of one hundred and fifty-seven were returned.

Library

Library space has been increased at the University Club, and all that is necessary at the moment is the appointment of a librarian and assistants to arrange the library properly.

Students' Prize

The Walter Moberly Memorial Prize

The second award of this prize was made to Mr. F. G. A. Tarr, of the 1926 Class of the University of British Columbia, for an essay on "The Stave Falls, B.C., Hydro-Electric Development."

Financial Statement

December 18th, 1925, to December 15th, 1926

Receipts

Cash on hand		$ 60.60	
Rebates on fees, Aug., 1925-Aug., 1926		444.62	
Branch news		18.42	
Library:			
Loan from headquarters	$300.00		
Sale of bookcases	67.50		
Contributions from sister societies using library	100.00		
		$467.50	
Rent of library from sister societies		$ 50.00	
			$1,041.14

Disbursements

Library:			
Capital expenditures:—			
Moving library and storage	$ 42.00		
	17.50		
Bookcases	140.00		
	170.10		
Labels for shelves	1.97		
Binding books	66.02		
	———	$437.59	
Library:			
Operating expenses:—			
Rent	$100.00		
Subscription "Canadian Engineer"	3.15		
	———	$103.15	
Rent of offices, Birks' Building		$ 75.00	
" Auditorium, Board of Trade, for meetings	$ 35.00		
" University Club for meetings...	16.00		
	———	$ 51.00	
Printing and stationery		$ 92.40	
Postage		47.03	
Exchange on cheques		1.20	
Expenses joint meeting, March 2nd		5.00	
Expenses dinner, March 5th		15.80	
Address plates for addressograph		2.55	
Filing drawer and card index		9.90	
Honorarium secretary		50.00	
Balance on hand, December 15th, 1926		150.52	
		———	$1,041.14

The balance of cash on hand, $150.52, shows an improvement over the previous years. This is due to the saving effected by moving the library.

One cheque was drawn on the Walter Moberly Memorial Fund for $25.00 to cover the prize awarded to Mr. F. G. A. Tarr. The balance in this account is $45.38.

The loan of $300.00 from headquarters for the development of the library has been expended on bookshelves and binding. There remains of this capital sum a balance of $29.99 unexpended.

Respectfully submitted,

F. W. Alexander, m.e.i.c., *Chairman.*
E. A. Wheatley, a.m.e.i.c., *Secretary-Treasurer.*

Victoria Branch

The President and Council,—

A good many changes have occurred in the membership of the branch during the year. Two new names, those of R. W. Hibberson, a.m.e.i.c., and Major J. C. MacDonald, m.e.i.c., have been added to the roll, but a number of members have left the city or severed their connection with the branch, the Executive particularly regretting the loss of several members by the removal of their names from The Institute roll for non-payment of dues.

The Executive is sorry to report that two members, J. MacGowan, and F. C. Gamble, past president of The Institute, died during the year.

Membership

The branch membership is as follows:—

	Resident	Non-Resident
Members	25	4
Associate Members	30	5
Juniors	1	..
Students	2	..
Branch Affiliates	1	..
	—	—
	59	9

The total branch membership is 68, compared with a reported total of 89 last year.

Management

The branch executive for the year has been:—

Chairman	J. N. Anderson, a.m.e.i.c.
Vice-Chairman	M. P. Blair, m.e.i.c.
Secretary-Treasurer	E. G. Marriott, a.m.e.i.c.
Executive	E. E. Brydone-Jack, m.e.i.c.
	R. F. Davy, a.m.e.i.c.
	E. P. Girdwood, m.e.i.c.
	P. Philip, m.e.i.c.
Ex-officio	F. C. Green, m.e.i.c., councillor
	G. B. Mitchell, m.e.i.c., past chairman

The Executive held seven meetings during the year, at which branch business was attended to.

The convenors of committees for the year were as follows:—

Papers	F. L. Macpherson, m.e.i.c.
Social	W. M. Everall, a.m.e.i.c.
Library	F. W. Knewstubb, a.m.e.i.c.
Town Planning	M. P. Blair, m.e.i.c.
Publicity	G. B. Mitchell, m.e.i.c.

The whole Executive acted as Attendance, Legislation, and Credentials committees.

F. W. Knewstubb, convenor of the Library Committee, reports the discontinuance of the subscription to the Contract Record, in lieu of which the proceedings of the American Society of Civil Engineers are being obtained; it is also noted that the Engineering News-Record, Scientific American, and The Institute Journal have been arranged in half-yearly volumes.

Meetings

The branch has been fortunate this last year in having an excellent series of addresses, lunches and outings, beginning on December 9th with a description of **"Engineering Life in Nicaragua, Peru and Chile,"** by G. B. Mitchell, m.e.i.c., who gave an account of his experiences in these countries, with many interesting references to the customs, climate and natural history that came under his observation.

In January, J. P. Forde, m.e.i.c., district engineer for the Dominion Public Works, took us by word and picture to the land of glacier and mountain, where nature is slowly presenting a new Pacific port to Canada at Tarr Inlet, Glacier bay, Alaska.

There were attendances of over forty at each of the February meetings, when addresses were given as follows: **"Earthquakes,"** by F. Napier Denison of the Gonzales Hill Meteorological Observatory, and **"The Mining Industry in British Columbia,"** by J. P. Galloway, provincial mineralogist.

At a lunch on February 22nd some thirty engineers gathered to offer congratulations to E. A. Cleveland, m.e.i.c., on his appointment as commissioner of the Greater Vancouver Water Board, and chairman of the Vancouver and District Joint Sewerage and Drainage Board.

At an evening meeting in March, J. H. McIntosh, s.e.i.c., explained the details of **"The Manufacture of Portland Cement as Practised at Bamberton"**; the display of a good range of samples of materials used, and of the product at different stages in the process of manufacture added to the interest of his paper.

A visit to the central Victoria fire hall the same month, at the invitation of Fire Chief Stewart, gave the members an opportunity to learn something of this part of the city service.

The **"Pacific Great Eastern Railway"** was the subject of an address by T. Kilpatrick, general manager of the line, at a meeting on March 31st.

In April members of the branch witnessed the launching of the second caisson for the Songhees graving dock, upon the invitation of N. A. Yarrow, a.m.e.i.c., and four days later a large party motored to Tod Inlet, where the ladies of the party enjoyed the renowned gardens of Mr. and Mrs. R. P. Butchart, while the men crossed over to Bamberton and made a thorough inspection of the cement works.

Between these two outings, P. Philip, m.e.i.c., deputy minister of public works, presented a paper on **"The New Fraser Canyon Section of the Cariboo Road."**

On June 30th the members of the branch entertained General Secretary R. J. Durley, m.e.i.c., to lunch, and took the opportunity of obtaining first-hand information regarding Institute affairs.

A series of moving pictures illustrating the construction and development of roads in the province, and the various industries that make use of them, was appreciated by many members on August 13th. The picture was exhibited through the courtesy of P. Philip, m.e.i.c.

In September a visit of unusual interest that attracted some fifty members and their friends was paid to the cable ship "Restorer," when Captain Livingstone and his officers explained the details of cable laying and repairing and the particular design of ship required for this work. Tea was served on board to the visitors.

The first October meeting was addressed by Mr. Doyle, works superintendent of the British America Paint Company, who gave those present a lot of very useful information on the materials used in the manufacture of paints and varnishes, with expert hints as to their advantages and disadvantages.

October 19th witnessed one of the outstanding events of the branch activities when His Honour R. R. Bruce, Lieutenant-Governor of the province, who is an engineer, was entertained at a luncheon of members of The Institute, and of the British Columbia Association of Professional Engineers. His Honour's reminiscences, review of engineering progress in Canada and the province, and suggestions for the future were much appreciated.

Nominations for the Executive for the present year took place on November 3rd, and after business was disposed of Major J. C. MacDonald, comptroller of water rights, drew upon his seven years' experience in the Okanagan, to give a survey of the irrigation, production and marketing problems that faced the growers of the Okanagan valley and adjoining districts, and outlined the various methods that had been adopted to meet succeeding difficulties as they occurred.

It was suitable that the last meeting should be an engineering luncheon on November 16th, at which the guest was Major Geo. A. Walkem, M.E.I.C., president of The Institute, and president of the British Columbia Association of Professional Engineers. Major Walkem spoke of the environment and progress of several branches of The Institute, incidentally giving interesting glimpses of industrial expansion at many points in the Dominion.

FINANCES

The branch's financial statement shows an increase in the balance on hand, which is largely owing to the payment of back dues to The Institute, the branch receiving a larger sum in rebates than usual.

FINANCIAL STATEMENT

For year ending November 3rd, 1926

Receipts

Balance on hand, Dec. 1st, 1925	$ 63.25	
Branch dues, 1925	3.00	
Branch dues, 1926	124.50	
Branch dues, 1927	3.00	
Rebates	192.00	
Branch news	47.00	
Journal for Affiliate	2.00	
		$434.75

Expenditures

Rent	$120.00	
Printing	35.75	
Typing	2.00	
Light	2.88	
Insurance	4.10	
Stationery	3.00	
Postage	23.49	
Rent of halls	11.00	
Telegrams	1.30	
Magazines	13.82	
Entertainment	5.70	
Miscellaneous	3.73	
Wreaths	7.50	
Journal	2.00	
Keys	1.00	
Honorarium	50.00	
Balance on hand, Nov. 30th, 1926	147.48	
		$434.75

Audited and found correct.

K. M. CHADWICK, M.E.I.C.
S. S. HODGSON, A.M.E.I.C. } *Auditors.*

Respectfully submitted,

E. DAVIS, M.E.I.C., *Chairman.*
KENNETH M. CHADWICK, M.E.I.C., *Secretary-Treasurer.*

Winnipeg Branch

The President and Council,—

The following report of the Winnipeg Branch is respectfully submitted:—

MEMBERSHIP

	Resident	Non-Resident	Total
Members	41	2	43
Associate Members	116	19	135
Juniors	14	4	18
Students	37	3	40
Affiliates	3	..	3
Branch Affiliates	10	..	10
Total	221	28	249

MEETINGS

Thirteen regular meetings were held according to the following list:—

Jan. 7.—"**Wood Destroying Fungi,**" by R. D. Prittie. Attendance 56.
Feb. 4.—"**Winter Operation of Motor Vehicles,**" by J. W. Dorsey. Attendance 64.
Feb. 18.—"**Story of Diphtheria,**" by Dr. J. A. Douglas. Attendance 27.
Mar. 4.—"**Advances in Artificial Illumination,**" by S. S. Vineberg, JR.E.I.C. Attendance 29.
Apr. 1.—"**Concrete Control,**" by L. J. Street, AFFILIATE E.I.C. Attendance 50.
Apr. 15.—"**Electrolytic Methods in Industry,**" by J. W. Sanger, A.M.E.I.C., and A. J. McDougall. Attendance 40.
May 6.— Annual meeting and election of officers. Attendance 40.
Oct. 7.—"**Foundations and Foundation Problems,**" by A. W. Fosness, A.M.E.I.C. Attendance 39.
Oct. 21.—Visit to plant of Canada Malting Company, Limited. Attendance 29.
Nov. 4.—"**Explosive Gases in Electric Boilers,**" by Dr. J. W. Shipley and C. F. Goodeve. Attendance 78.
Nov. 18.—"**Prospects for Mining in Manitoba,**" by Dr. J. S. Delury. Attendance 37.
Dec. 2.—"**Strength of Ice in Shear and Compression,**" by J. N. Finlayson, M.E.I.C., and H. E. Treble, S.E.I.C. Attendance 36.
Dec. 16.—"**The Automatic Telephone in Winnipeg,**" by E. H. Williams, and visit to the Sherbrooke street Exchange. Attendance 39.

In February the branch, jointly with the Association of Professional Engineers, entertained Major Geo. A. Walkem, M.E.I.C., president of The Institute, at a social evening in the Marlborough hotel.

In June the branch welcomed R. J. Durley, M.E.I.C., the general secretary, on his official visit.

In July the branch was represented at a joint meeting of the Saskatchewan branches of the E.I.C., A.I.E.E., and C.I.M. & M., at Estevan, where a very instructive and enjoyable convention took place.

In August over forty, including families, accepted the kind invitation of the Federation of Engineers and Architects of the adjoining States to meet with them at Duluth, where a most interesting and pleasant time was spent. In 1925 the convention was held in Winnipeg, and in 1927 a large number plan to accept the invitation to meet in St. Paul. On each occasion the branch was joined by members of the other engineering and mining bodies and the local architects, and it is earnestly hoped that the event will develop into an annual one, meeting from time to time in Winnipeg. The benefits arising from such meetings between engineers, whose problems are so similar, are many and far-reaching.

The branch has accepted the kind invitation of the local branch of the Canadian Institute of Mining and Metallurgy to join them in entertaining the members of the British Empire Mining Congress and British Iron and Steel Institute on their trans-Canadian tour, when they stop off in Manitoba next summer.

This has been the transition year when the official year of the branch, formerly closing in May, has been made to conform with that of headquarters. Hitherto considerable confusion has occurred due to them overlapping.

During the year the branch completed the revised by-laws, which have not as yet been formally approved by headquarters.

The following is a brief financial statement and is in detail only from May 6th, the close of the branch year 1925-26:—

FINANCIAL STATEMENT

Receipts

Bank balance, May 6th	$ 772.35	
Cash on hand	10.72	
Local dues received	361.50	
Rebates from headquarters	404.44	
Branch news and advertising	23.39	
Bond interest	27.50	
Miscellaneous adjustments	23.37	
		$1,623.27

Expenditures

Total expenditures	$ 490.15	
Balance on hand	1,133.12	
		$1,623.27

Respectfully submitted,

N. M. HALL, M.E.I.C., *Chairman.*
JAMES QUAIL, A.M.E.I.C., *Secretary-Treasurer.*

THE
ENGINEERING JOURNAL

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The Report of the Joint Board of Engineers on the St. Lawrence Waterway Project

The text of this Report, (apart from the appendices), dated November 16th, 1926, is now available to the public, and, as might be expected in the case of any communication from such a distinguished body of engineers, merits the most careful study.

The personnel of the Joint Board consisted of an American and a Canadian section, the former composed of three officers of the United States Corps of Engineers, (Major-General Jadwin, Colonel Kelly and Lieut.-Colonel Pillsbury), the latter having as its members Messrs. D. W. McLachlan, O. O. Lefebvre, and Brigadier-General C. H. Mitchell, all Members of The Institute.

The Board's instructions touched on practically all the pressing engineering questions connected with the St. Lawrence river and the Great Lakes which have concerned the public of Canada and the United States so greatly during the past few years. It is important to note that while these instructions directed the Board to outline the works best adapted to give certain results, the Board was not asked for, and does not express, any opinion regarding the advisability of undertaking such works.

Questions relating to the improvement of the St. Lawrence between lake Ontario and Montreal for navigation and power purposes were referred to the International Joint Commission in 1920, and in 1921 a technical report by Colonel W. P. Wooten, United States Corps of Engineers, and the late Mr. W. A. Bowden, chief engineer of the Department of Railways and Canals, Ottawa, was submitted to the International Joint Commission. This Report of 1921, of course, formed part of the data available for the Joint Board's consideration. It estimated the cost of a 25-foot navigation channel between lake Ontario and Montreal at some two hundred and fifty million dollars, this figure including a power development of nearly two million horse power (installed capacity). As a matter of fact, the Joint Board of Engineers broadly endorses the Report of 1921, but recommends a number of important additions and modifications, which, while increasing the estimated cost, would, in the Board's opinion, provide to the best advantage for the development of the full capacity and possibilities of the waterway. The plans now suggested by the Board, would provide all the facilities contemplated in the Report of 1921, and would also render possible, first, the development of the entire power possibilities of the International Rapids Section of the river, (48 miles of rapids terminating at the head of lake St. Francis); secondly, the progressive development of power in addition to navigation facilities in the Soulanges section, (that between lake St. Francis and lake St. Louis); and, thirdly, important improvements in the navigation canal and in the control works at lake St. Louis affecting the section just below Montreal Harbour.

The total estimated cost of the works now outlined, (exclusive of interest during construction), is in the neighbourhood of four hundred million dollars. This amount would provide for a 25-foot navigation channel and the immediate development of more than two and a half million installed horse power. Subsequent complete development of the power resources of the river, with an additional installed capacity of another two and a half million horse power, would involve a further expenditure of about two hundred and twenty-five million dollars.

In treating of the vexed question of change of water levels in the river and on the Great Lakes, the Board is of the opinion that if the improvements they describe were constructed and operated under adequate government supervision they could be so controlled as neither to lower the summer levels in the lower river nor raise the winter and spring levels. The Board points out that the levels of the Great Lakes above lake Ontario cannot be affected by any works in the St. Lawrence proper.

The Board's study of the effect of the various diversions of water from the Great Lakes has led to the interesting conclusion that the diversion by the Chicago Sanitary District of 8,500 cu. ft. per second through the Chicago Drainage Canal, as licensed by the United States government, has lowered the water levels of the Great Lakes by from four- to five-tenths of a foot, and has had a lesser but very definite effect on points lower down, lowering the water level in Montreal Harbour by 0.37 ft. The effect of other diversions, including those for navigation and other purposes, is also dealt with in detail.

The Board finds further that the effect of the authorized diversions on the St. Lawrence water level at and below Montreal could be restored by dredging and accessory works at an estimated cost of between four and five million dollars, and points out that after the river has been fully developed for power production, no works could be constructed which would recover on the St. Lawrence the power lost by the diversion of water from the watershed.

It is considered that compensating works would be preferable to regulating works for the purpose of restoring the water levels of lakes Michigan, Huron and Erie, while the effect of the diversions on the levels of the lakes and the St. Lawrence above Montreal could be removed by the works provided for the improvement of this part of the St. Lawrence.

The Report regards it as essential that not only should the works within the international sections be designed and constructed under the technical supervision of an international authority, but that an international control board should be created, having full power to regulate the use of water by the power plants in the international sections, in order that such use may be prevented from creating conditions harmful to navigation, and so that the requirements of all the power plants on the river may be fully met at all times.

It is estimated that the new waterway could be opened to navigation in from seven to eight years from the time that active work is begun.

The Joint Board received its instructions from the United States and Canadian governments almost two years ago, and while a large volume of data collected for the Report of 1921 and for other purposes was available, it was found necessary to conduct a comprehensive programme of investigation, including borings, surveys and discharge meterings, which was completed in the summer of 1926. The Canadian section of the Board carried on in the winter an extensive set of temperature measurements to determine the rate of loss of heat in the river, and made a series of experiments to ascertain the resistance of ice as bearing on the design of dams. The Appendices to the Report, which will shortly be available, describe the Board's investigations more fully.

The result of the Board's labours is a lucid, authoritative document, bearing evidence of thorough study and expressing the verdict of a sound and mature judgment. The Report gives us a series of definite statements which should do much to remove the possibility of misunderstanding and afford a firm basis for international negotiations.

Award of Gzowski Medal


LESSLIE R. THOMSON, M.E.I.C.

The award of the Gzowski Medal, for the season 1925-1926, which was announced in the report of the Gzowski Medal Committee at the Annual Meeting of The Institute in Quebec on February 15th, was made to Lesslie R. Thomson, M.E.I.C., consulting engineer, Montreal, for his paper, "The Fuel Problem in Canada," presented at the Annual General Meeting of The Institute in Toronto on January 29th, 1926, and published in the Engineering Journal in February 1926.

Mr. Thomson's early education was received at Upper Canada College, Toronto, following which he attended the University of Toronto, graduating in mechanical engineering in 1905 and civil engineering in 1907. He later received his degree of B.A.Sc. after the completion of a course of study specializing in hydraulics and strength of materials.

During the summers of his university course he was assistant engineer with the late Jos. Rielle, of Montreal, and, following graduation, he was appointed, in 1910, lecturer in civil engineering of the University of Manitoba. Two years later he joined the Dominion Bridge Company, Montreal, as assistant engineer, remaining with this company for six years.

In 1918 Mr. Thomson was secretary to the Advisory Research Council at Ottawa, and was for six years secretary of the Lignite Utilization Board. In 1921 he was appointed special lecturer in structural engineering in the department of architecture at McGill University, which position he still holds. About two years ago he entered private practice in Montreal.

Mr. Thomson joined The Institute as an Associate Member on April 8th, 1911, and was transferred to the grade of Member on January 24th, 1919. He is also a member of the American Society of Civil Engineers, the Corporation of Professional Engineers of Quebec and a charter member of the Association of Consulting Engineers of Canada.

Mr. Thomson has made many contributions to technical literature, among which are:—"The Rolling and Floating Caissons of the Levis Dry Dock," presented to the Engineering Institute of Canada in 1915; "Transmission Lines, Poles and Towers," presented to the Engineering Institute of Canada in 1916; "The Briquetting of Lignites," presented to the Society of Chemical Industry in 1921; "Fuel Problem of Canada," presented to the Engineering Institute of Canada in January 1926, and "Low Temperature Semi-Coke in Briquetted Form as a Domestic Fuel," prepared in conjunction with Mr. C. V. McIntire, New York, and presented to the American Chemical Society in September 1926. He was also responsible for the first general report of the Lignite Utilization Board of Canada, published in March 1924.

A Disclaimer

With reference to the paper by Mr. Theo. C. Denis on the Mineral Deposits of the Rouyn-Harricana Region, presented at the recent Quebec Meeting and published in the Engineering Journal for February, we are informed that a firm of financial agents has addressed a letter-circular to all members of The Institute, in which allusion is made to Mr. Denis' paper; the circular suggests that members of The Institute should at once invest in a certain mining property in the district in question.

It is hardly necessary to point out that use of the article in the Journal in this manner has not been authorized, nor does it meet with the approval of either The Institute or the author of the paper. In this connection, it is thought desirable to call attention to the warning contained in the fourth paragraph from the end of Mr. Denis' paper.

The Forty-first Annual General and General Professional Meeting

Convened at Headquarters, Montreal, January 27th, and Adjourned to Quebec, February 15th, 16th and 17th, 1927

Annual General Meeting—Montreal Session

The Forty-first Annual General Meeting of The Institute was held at Headquarters on Thursday evening, January twenty-seventh, nineteen hundred and twenty-seven. Vice-President K. B. Thornton, M.E.I.C., took the chair at eighty-thirty p.m.

Reading of Minutes

The minutes of the fortieth annual general meeting were submitted, and on motion of Geo. R. MacLeod, M.E.I.C., seconded by J. L. Busfield, M.E.I.C., were taken as read, and confirmed.

Appointment of Scrutineers

On motion of J. T. Farmer, M.E.I.C., seconded by J. G. Caron, A.M.E.I.C., Messrs. L. T. G. Boisseau, A.M.E.I.C., and H. G. Thompson, Jr.E.I.C., were appointed scrutineers to report the result of the Officers' ballot.

Forty-First Annual General and General Professional Meeting of The Engineering Institute of Canada, Held at Quebec on the 15th, 16th and 17th February, 1927.

Appointment of Auditors

On motion of C. K. McLeod, A.M.E.I.C., seconded by J. A. Burnett, M.E.I.C., Messrs. Riddell, Stead, Graham and Hutchison were appointed auditors for the ensuing year.

There being no other formal business, it was resolved, on motion of J. L. Busfield, M.E.I.C., seconded by H. Massue, A.M.E.I.C., that the meeting should adjourn, to reconvene on Tuesday, February fifteenth, nineteen twenty-seven, at ten a.m., at the Chateau Frontenac, Quebec, Que.

The meeting adjourned at eight forty-five p.m.

Quebec Sessions

The meeting was called to order by Vice-President K. B. Thornton, M.E.I.C., at ten o'clock on February 15th, 1927, in the Jacques Cartier Room of the Chateau Frontenac, Quebec City. The Secretary read a telegram from President Geo. A. Walkem, M.L.A., M.E.I.C., expressing his regrets at being unable to be present, owing to the legislature of British Columbia being in session, and extending his good wishes.

Reading of Minutes

The secretary read the minutes of the formal business meeting held in Montreal on January 27th, 1927, which were adopted.

Reports of Council and Committees

In presenting the Report of Council for 1926, as published on page 138 of the March issue of the Journal, the chairman drew attention to Council's recommendation regarding the provision of facilities for councillors residing at a distance from Headquarters to attend a meeting of Council at least once a year, and also remarked on the sound financial condition disclosed by the Finance Committee's report, this being due to the action of Council in removing from the membership roll members seriously in arrears. On the motion of Brig.-Gen. C. H. Mitchell, M.E.I.C., seconded by E. A. Forward, M.E.I.C., the report of Council was adopted.

The report of the Legislation and By-laws Committee was presented by Geo. R. MacLeod, M.E.I.C., who outlined the reasons for recommending the amendments to the By-laws contained in the report, these amendments having been printed in the Journal on page 140 of the March issue. On motion by Geo. R. MacLeod, M.E.I.C., seconded by J. L. Busfield, M.E.I.C., the report was adopted, the secretary being instructed to send out the amendments for vote by the membership in accordance with section 76 of the By-laws.

The chairman stated that Council had appointed J. A. Burnett, M.E.I.C., as chairman of the Nominating Committee for 1927, and announced the membership of the committee as printed on page 140 of the March issue of the Journal.

After a brief discussion the report of the Finance Committee, as published on page 141 of the March issue of the Journal, was approved on the motion of F. P. Shearwood, M.E.I.C., seconded by J. A. McCrory, M.E.I.C.

The report of the Papers Committee, as published on page 143 of the March issue of the Journal, was presented by J. L. Busfield, M.E.I.C., who pointed out that the committee had in several cases been able to arrange for speakers to make tours, during which they addressed meetings at several branches. W. J. Johnston, A.M.E.I.C., considered that the Papers Committee should include a representative from each branch, but expressed his willingness to withdraw the paragraph in the report as printed emphasizing his views on this point. Mr. Johnston also pointed out that it was the duty of the branch secretary or the branch representative on the Papers Committee to see that copies of important papers presented at branches are forwarded to Headquarters for possible publication, or reference, or so as to be available for use for other branches. Brig.-Gen. Mitchell suggested that the report, if adopted, should carry the recommendation that expenses incurred by writers of papers, if presented at distant branches, should be covered to a certain extent by an appropriation by Council. On the motion of J. L. Busfield, M.E.I.C., seconded by C. H. Wright, M.E.I.C., the report was adopted, with a special recommendation to the incoming Council to give the above suggestions careful consideration.

The report of the Publications Committee, as published on page 143 of the March issue of the Journal, was adopted on the motion of J. L. Busfield, M.E.I.C., seconded by Geo. R. MacLeod, M.E.I.C.

The report of the Library and House Committee, as published on page 143 of the March issue of the Journal, was adopted on the motion of Geo. R. MacLeod, M.E.I.C., seconded by Major Stuart Howard, M.E.I.C.

On the motion of Geo. R. MacLeod, M.E.I.C., seconded by J. W. Seens, A.M.E.I.C., the report of the Board of Examiners and Education, as published on page 144 of the March issue of the Journal, was adopted.

The secretary read the report of the Gzowski Medal Committee, and on the motion of C. K. MacLeod, A.M.E.I.C., seconded by J. W. Seens, A.M.E.I.C., this report, together with those of the Leonard Medal, Plummer Medal and Students' Prizes Committees, as published on page 145 of the March issue of the Journal, were adopted.

In moving the adoption of the report of the Committee on International Co-operation, as published on page 146 of the March issue of the Journal, J. B. Challies, M.E.I.C., referred to the excellent work of this committee in connection with the visit of the International Electrotechnical Commission. On his motion, seconded by L. C. Dupuis, A.M.E.I.C., the report was adopted.

The report of the Canadian National Committee of the International Electrotechnical Commission, as published on page 146 of the March issue of the Journal, was adopted on the motion of J. B. Challies, M.E.I.C., seconded by Geo. R. MacLeod, M.E.I.C.

On the motion of F. P. Shearwood, M.E.I.C., seconded by J. W. Seens, A.M.E.I.C., the report of the Code of Ethics Committee, as published on page 147 of the March issue of the Journal, was adopted.

The report of the Honour Roll and War Trophies Committee, as published on page 147 of the March issue of the Journal, was adopted on the motion of Brig.-Gen. C. H. Mitchell, M.E.I.C., seconded by P. L. Pratley, M.E.I.C.

On motion of P. L. Pratley, M.E.I.C., seconded by L. C. Dupuis, A.M.E.I.C., the report of The Institute's Members of the Main Committee of the Canadian Engineering Standards Association, as published on page 147 of the March issue of the Journal, was adopted.

The report of the Committee on Deterioration of Con-

Quarante-et-Uniéme Assemblée Générale Annuelle et Général Professionel de L'Institut des Ingénieurs du Canada, Tenus à Québec, les 15, 16 et 17 Février, 1927.

crete in Alkali Soils, as published on page 148 of the March issue of the Journal, was adopted on the motion of Geo. R. MacLeod, M.E.I.C., seconded by J. W. Seens, A.M.E.I.C.

On the motion of K. M. Cameron, M.E.I.C., seconded by L. C. Dupuis, A.M.E.I.C., the report on the work of the Committee on Young Graduates, as published on page 149 of the March issue of the Journal, was adopted.

Branch Reports

The reports of the various branches, as published on pages 150 to 167 inclusive of the March issue of the Journal, were presented and briefly commented upon by branch representatives present, as follows:—Halifax Branch, C. H. Wright, M.E.I.C.; Toronto Branch, J. W. Falkner, A.M.E.I.C.; Border Cities Branch, C. M. Goodrich, M.E.I.C.; Quebec Branch, W. G. Mitchell, M.E.I.C.; Ottawa Branch, K. M. Cameron, M.E.I.C.

Mr. Busfield drew attention to the inconvenience arising from the facts that the various branch executive committees take office at different times of the year, and that branch fiscal years do not commence at the same time; he hoped that the Legislation and By-laws Committee would be asked to give consideration to this matter, and that the branches would be communicated with, to see if some uniform arrangement could not be made. C. K. MacLeod, A.M.E.I.C., did not think that a branch fiscal year need necessarily end on the same date as that of The Institute as a whole, but he thought that they should all end on the same date. After a brief discussion, and with the inclusion of this recommendation, the branch reports were adopted, on motion by J. W. Seens, A.M.E.I.C., seconded by C. K. MacLeod, A.M.E.I.C.

Retiring President's Address

The secretary read the retiring president's address, and on the motion of J. L. Busfield, M.E.I.C., seconded by Geo. R. MacLeod, M.E.I.C., a telegram was sent to Major Geo. A. Walkem, M.L.A., M.E.I.C., thanking him for his address and his work during the year, and regretting that he was unable to be present.

The meeting adjourned at 12:10 noon.

On re-assembling at 2:00 p.m., the report of the Committee on Engineering Education, as published on page 145 of the March issue of the Journal, was presented by its chairman, Frederick B. Brown, M.E.I.C., who drew attention to the magnitude of the problems before the committee, and their importance, not only to The Institute, but to the various Associations of Professional Engineers and to the universities. He expressed the hope that these bodies, as well as The Institute, would offer every possible assistance to the Society for the Promotion of Engineering Education. Active discussion took place upon the various problems and questions outlined in the report, important contributions being made by Brig.-Gen. C. H. Mitchell, M.E.I.C., Calvin W. Rice, secretary of A.S.M.E., L. W. Gill, M.E.I.C., Dr. A. Frigon, A.M.E.I.C., Geo. T. Seabury, secretary of A.S.C.E., A. A. Bowman, M.E.I.C., C. H. Wright, M.E.I.C., W. G. Chace, M.E.I.C., D. C. Tennant, M.E.I.C., and Prof. A. F. Baird, A.M.E.I.C. On the motion of Frederick B. Brown, M.E.I.C., seconded by J. C. Craig, M.E.I.C., the report on Engineering Education was adopted.

Election of Officers

The secretary read the report of the scrutineers, announcing the election of officers as follows:—

President	A. R. Decary, M.E.I.C.
Vice-Presidents:	
Zone A	S. G. Porter, M.E.I.C.
Zone C	J. H. Hunter, M.E.I.C.
Councillors:	
Victoria Branch District	J. N. Anderson, A.M.E.I.C.
Vancouver Branch District	E. A. Cleveland, M.E.I.C.
Calgary Branch District	A. L. Ford, M.E.I.C.
Edmonton Branch District	R. W. Boyle, M.E.I.C.
Lethbridge Branch District	P. M. Sauder, M.E.I.C.
Saskatchewan Branch District	H. R. MacKenzie, A.M.E.I.C.
Winnipeg Branch District	A. McGillivray, A.M.E.I.C.
Lakehead Branch District	J. Antonisen, M.E.I.C.
Sault Ste. Marie Branch District	C. H. E. Rounthwaite, A.M.E.I.C.
Border Cities Branch District	J. Clark Keith, A.M.E.I.C.
Niagara Peninsula Branch District	E. P. Johnson, A.M.E.I.C.
London Branch District	W. C. Miller, A.M.E.I.C.
Hamilton Branch District	W. F. McLaren, M.E.I.C.
Toronto Branch District	T. R. Loudon, M.E.I.C.
Kingston Branch District	L. F. Grant, A.M.E.I.C.
Peterborough Branch District	R. L. Dobbin, M.E.I.C.
Ottawa Branch District	A. F. Macallum, M.E.I.C.
Montreal Branch District	W. C. Adams, M.E.I.C.
	P. L. Pratley, M.E.I.C.
Quebec Branch District	A. B. Normandin, A.M.E.I.C.
Saguenay Branch District	G. F. Layne, A.M.E.I.C.
Moncton Branch District	H. W. McKiel, M.E.I.C.
Saint John Branch District	Geoffrey Stead, M.E.I.C.
Cape Breton Branch District	W. C. Risley, M.E.I.C.
Halifax Branch District	K. L. Dawson, A.M.E.I.C.

Inauguration of Newly-Elected President

The chairman requested C. H. Wright, M.E.I.C., and W. G. Chace, M.E.I.C., to conduct the incoming president to the chair. The newly-elected president, A. R. Decary, M.E.I.C., of Quebec City, accordingly took the chair, and in a few words expressed his appreciation of the honour done him, and his pleasure at the hearty welcome accorded to him.

Votes of Thanks

On the motion of A. A. Bowman, M.E.I.C., seconded by C. K. MacLeod, A.M.E.I.C., it was resolved to extend to the scrutineers a vote of thanks for their efficient work in connection with their duties.

On the motion of Brig.-Gen. C. H. Mitchell, M.E.I.C., seconded by W. G. Chace, M.E.I.C., it was unanimously resolved that the secretary convey to the officers and members of the Quebec Branch the thanks and appreciation of The Institute on the occasion of the Forty-First Annual General Meeting, expressing appreciation of the efficient manner in which the arrangements for the annual meeting had been made, and gratitude for their generous hospitality.

There being no further business, the meeting adjourned at 5:15 p.m.

Annual General Professional Meeting

The first session of the General Professional Meeting was held at 10 a.m. on Wednesday, February 16th, 1927, when the Hon. H. Mercier, Minister of Lands and Forests, province of Quebec, delivered a brief introductory address. Following Mr. Mercier's address technical sessions were held in the Jacques Cartier Room under the chairmanship of Major J. A. Duchastel, M.E.I.C., and in the Committee Room under the chairmanship of W. G. Mitchell, M.E.I.C., when the following papers were respectively presented:—

"Notes on the Forests of Quebec," by G. C. Piché, A.M.E.I.C.

"The Wood Consuming Industries of Canada," by John Stadler, M.E.I.C.

"Woodlands Management and Operation," by S. L. deCarteret, M.E.I.C.

"Transportation in Pulpwood Operations," by G. E. LaMothe, A.M.E.I.C.

"Electrical Characteristics of Quebec-Isle Maligne Transmission Line," by Prof. C. V. Christie, M.E.I.C.

"Alternating Current Electrolysis," by Prof. J. W. Shipley and Chas. F. Goodeve.

"Building an Industrial Plant in the Saguenay District," by John L. Guest, A.M.E.I.C.

"Protection Against Seepage at Lake Kenogami," by O. O. Lefebvre, M.E.I.C.

Active discussion took place, particularly on the papers dealing with forestry problems, and it was therefore necessary to defer the consideration of the papers by Messrs. deCarteret and LaMothe to the afternoon of Thursday.

The Meeting was resumed on Thursday morning when the following papers were presented and discussed under the chairmanship of J. B. Challies, M.E.I.C.:—

"Rack Structure and Penstock Intake of the Isle Maligne Hydro-Electric Power Station," by W. S. Lee, M.E.I.C.

"The Water Power Developments of the Alouette-Stave-Ruskin Group," by E. E. Carpenter, M.E.I.C.

"Hydro-Electric Developments on the Gatineau River," by J. A. McCrory, M.E.I.C.

In the afternoon, previous to the consideration of two mining papers by Theo. C. Denis on "Notes on the Ore Deposits of Western Quebec," and W. R. Rogers, A.M.E.I.C., on "The Metal Mining Industry of Northern Ontario," the Hon. J. E. Perrault, Minister of Mines, Province of Quebec, gave a brief introductory address.

Luncheons

At noon on Tuesday, February 15th, a complimentary luncheon to the visiting members was given by the members of the Quebec Branch, in the Riverview Dining Room of the Chateau Frontenac, when some two hundred were present. At this luncheon the members were welcomed by the chairman of the Quebec Branch, A. B. Normandin, A.M.E.I.C., and His Worship Mayor Martin, of Quebec, in speeches in both French and English. The Hon. W. Gerard Power, chairman of the Quebec Harbour Commissioners, gave a short address outlining the development of the Port of Quebec during the last two years, referring to the important part played by the engineers in this work.

At the same time the visiting ladies were the guests of the Quebec Branch at a luncheon held in the Private Dining Room, at which Mrs. S. L. deCarteret, chairman of the Ladies' Committee, presided, and in a very pleasing address welcomed the visiting ladies.

Smoker

Commencing at 8:30 p.m. on Tuesday, February 15th, a complimentary smoker for the visting members was held, and proved a most enjoyable function. It was originally intended to hold this event in the Riverview Dining Room, but on account of the large attendance the Ball Room had to be used. During the course of a continuous cabaret entertainment light refreshments were served.

Theatre Party for Ladies

On the same evening while the smoker was in progress the visiting ladies were entertained at a theatre party at the Auditorium.

Visit to the Quebec Bridge

On Wednesday, February 16th, at 2:00 p.m., the members gathered on the Dufferin Terrace, where the convention photograph was taken; embarking immediately afterwards on special cars provided by the Quebec Power Company for conveyance to the wharf where the Government Icebreaker "Mikula" was lying with steam up, ready to demonstrate its power in forcing a passage through the solid ice at the mouth of the St. Charles river and through the large ice floes in the tideway of the St. Lawrence. The "Mikula" left at 2:45 p.m. and steamed without any difficulty up the river as far as the Quebec bridge, returning to the dock shortly after 5 p.m. This instructive and interesting excursion was made possible through the courtesy of the officers of the Department of Marine and Fisheries, and afforded a most convincing illustration of the capabilities of the modern ice-breaking steamer.

During Wednesday afternoon the visiting ladies were the guests of the Quebec Ladies' Musical Club, where a most enjoyable programme was given.

Annual Dinner

The outstanding function of the meeting was the Annual Dinner, which was held in the Ball Room on Wednesday evening, February 16th, at which the newly-elected president, A. R. Decary, M.E.I.C., took the chair. The principal speaker of the evening was Sir Henry Worth Thornton, M.E.I.C., President, Canadian National Railways, whose address, while vibrant with humour, carried the message of the importance of a knowledge of the classics and general cultural subjects as an essential to the progress and advancement of the successful engineer. Previous to Sir Henry Thornton's speech, Sir François Lemieux, Administrator of the province of Quebec, delivered a felicitous address in both French and English. Other speakers of the evening were:—Mgr. Camille Roy, Rector of Laval University, Quebec; the Hon. Lucien Cannon, Solicitor-General, Ottawa; the Hon. J. L. Perron, Minister of Roads, province of Quebec; Mr. Calvin W. Rice, Secretary, American Society of Mechanical Engineers; and Mr. Geo. T. Seabury, Secretary, American Society of Civil Engineers.

On the same evening, Mrs. S. L. deCarteret presided at a dinner given to the ladies, which was largely attended and very much enjoyed. At its close, Mrs. A. F. Byers of Montreal, on behalf of the visiting ladies, thanked the ladies of Quebec in a happy speech for their most generous hospitality, after which the company adjourned to the gallery of the Ball Room, and heard the speeches at the Annual Dinner of The Institute.

Visit to Anglo-Canadian Pulp and Paper Mills

At noon on Thursday, February 17th, through the courtesy of W. I. Bishop, M.E.I.C., the members were given an opportunity to visit the Anglo-Canadian Pulp and Paper Mills under construction at Limoilou, Que., where they were entertained at luncheon at the company's canteen on the mill site, and were able to inspect the construction work of the new mills.

Afternoon Tea for Ladies

On the afternoon of Thursday, February 17th, the visiting ladies were entertained at tea.

Supper-Dance and Bridge

The closing function of the meeting was the Supper-Dance and Bridge, which was held in the Ball Room on the evening of Thursday, February 17th. Dancing commenced at 8:30 p.m. and supper was served at midnight. This proved one of the most enjoyable functions, and was a fitting climax to the other delightful social events of the meeting.

Albert R. Decary, M.E.I.C.

President, The Engineering Institute of Canada

A keen devotion to high standards coupled with the utmost energy and persistence towards reaching a goal are characteristic of both the engineering works and professional activities of Albert R. Decary, M.E.I.C., President of the Engineering Institute of Canada for the year nineteen hundred and twenty-seven, and are reflected in the services he faithfully rendered during twenty-seven years to one of the largest engineering organizations in the Dominion of Canada as well as to The Institute and the profession.

Mr. Decary was born in Montreal, Que., on the twenty-first day of October, eighteen hundred and seventy-five. He received his education at the St. Mary's College, (Jesuits), in Montreal, and at the Ecole Polytecnique de Montréal. After a few years of private practice in that city, he became associated with the Department of Public Works of Canada, for which he was engaged in hydrographic work on the St. Lawrence river, between Kingston and Quebec, from 1900 to 1905. At that date, he was appointed district engineer at Quebec, which office he held until 1913, when he became superintending engineer, having jurisdiction over the province of Quebec for the Department of Public Works of Canada.

He was intimately connected with all the important river and harbour works made by the Dominion Government since 1900, including the Champlain dry dock, at Quebec, and the New Esquimalt dry dock, in British Columbia; in connection with this latter big undertaking, he was chairman of the Board of Engineers specially entrusted with the designing and preparation of all plans.

ALBERT R. DECARY, M.E.I.C.

It was in 1900 that Mr. Decary joined the Engineering Institute of Canada, having been elected an Associate Member, and in 1907 that he was transferred to the grade of Member. From the beginning, he took a most active interest in the affairs of the organization and played a prominent part in all matters pertaining to the administration, the welfare and the advancement of The Institute. He was made a councillor in 1914 and sat on the Council of The Institute in that capacity until 1924, when he became vice-president. A number of important special committees of The Institute, such as the Committee on Memberships, the Committee on Society Affairs, the Committee on Classification and Remuneration, the Special Committee on Legislation, the Committee on Policy, the Committee on Professional Relationship, etc., have also taken much of his time and have largely benefited by his wide experience of men and things.

When the Quebec Branch of The Institute was formed, in January 1907, Mr. Decary was found among its principal promoters; he was one of the charter members of this branch and a member of the first Executive Committee, an officer of which he has remained ever since. No one has ever been so closely connected with the history of any branch of The Institute, or has performed a greater amount of useful work towards promoting the interests of The Institute and the profession in any locality. He was chairman of the Quebec Branch for eight years; in 1913 and from 1919 to 1925. Upon retiring from the active chairmanship of this branch, the Quebec members made him their Honorary Chairman for Life, by resolution of their annual meeting in 1925 and in recognition of his exceptionally capable management of the branch affairs and untiring activities which had practically identified him with the existence of the branch itself.

A biographical sketch of the new President of The Engineering Institute of Canada would be far from complete were it not mentioned that he was mainly responsible for the establishing of the Corporation of Professional Engineers of Quebec, a body which was granted the same privileges and legal powers long enjoyed by the other professions of that province. He was elected the first president of the Corporation in 1920, which highly responsible office has been committed to him from year to year since that date.

Mr. Decary is also a member of the Province of Quebec Association of Architects, a Fellow of the Royal Architectural Institute of Canada and holds membership in the Quebec Board of Trade, the Permanent International Association of Navigation Congresses, the Canadian Institute, the Quebec Geographic Society, the Canadian Forestry Association, the Canadian Club, the Quebec Garrison Club, the Engineers' Club of Montreal, the Quebec Golf Club, the Royal St. Lawrence Yacht Club of Montreal, the Quebec Yacht Club, (Honorary Member), and other organizations.

The loyalty and rare executive ability which Mr. Decary always displayed, although in a quiet but energetic manner, in the service of The Institute and the profession will not fail to be truly appreciated by all in the performance of the duties of the high office with which he has just been invested.

Address of the Retiring President,

Major Geo. A. Walkem, M.E.I.C.

Read before the Forty-first Annual General Meeting of The Engineering Institute of Canada, Quebec, Que., February 15th, 1927

Members of the Engineering Institute of Canada,

Gentlemen:—

It is with regret that I realize while writing this address that it will be impossible for me to be present in person at the Annual Meeting and deliver it. The Legislature of the Province of British Columbia, of which I am a Member, will be still in session when the Annual Meeting is held, and my legislative duties will therefore prevent me visiting the East at that time.

During my term as your President,—the President of the oldest and largest technical society in Canada,—I have felt a deep sense of responsibility. I realized that a President living three thousand miles from Headquarters cannot be very useful as an actual Presiding Officer, and decided, therefore, that I could best serve The Institute by acting as a kind of visiting director. Following out this idea, I visited the following branches during two trips, one in January 1926 and one last October:—Montreal, Quebec, Saguenay, Ottawa, Kingston, Peterborough, Toronto, Hamilton, London, Border Cities, Sault Ste. Marie, Port Arthur, Winnipeg, Regina, Saskatoon, Calgary, Lethbridge, Vancouver and Victoria, and it is my intention to visit Edmonton, (where, as Vice-President, I presented the charter), during the month of March. Everywhere, as your President, I had a warm welcome, and was afforded an opportunity of seeing something of the handicaps under which some of these branches operate, and their loyalty to The Institute. In the cities, of course, where the membership is large, the branches function well; in the smaller places, however, where the branch draws its membership from a large territory, the geographical difficulties of holding meetings and getting together make themselves felt. The problem of what Headquarters can do for such branches, to assist and interest, is one to which I have given a great deal of thought. It is further complicated by the formation of the various Associations of Professional Engineers in the different provinces. My conclusions are those that have already been suggested and discussed by Council, viz.:—

(1) Obtain papers on technical subjects by eminent engineers, with the necessary lantern slides, which papers and slides can be used by the different branches.

(2) Have, if possible, a three-day meeting at Headquarters in June, to which a councillor from each zone could come.

(3) Arrange for visits by your President and Secretary as often as possible.

(4) Continue publication of the Transactions.

I think by these means Headquarters will be able to keep in closer touch with the various branches, and, what is even of greater importance, bring the branches in closer touch with each other.

As mentioned in the Report of Council, a meeting of the representatives of the Associations of Professional Engineers was held at Headquarters in February last. They met at the suggestion and on the invitation of The Institute, but The Institute as an institute took no part in the deliberations. A three-day meeting was held, and I am sure that the result of these debates will eventually be of immense benefit to The Institute; in fact, it is my hope that after a period of some years all the Professional Engineers' Associations throughout Canada will be one body, with, perhaps, The Institute as a parent. I think I am right in saying that the discussion throughout showed that this must eventually be the case.

During the year Council has received communications from several members who were of opinion that Council should more frequently discuss questions of public importance that were at the time agitating the public mind, and that concerned engineers and engineering; and, being largely interested in public affairs, I personally have a great deal of sympathy with their views. I realize, however, that up to the present time The Institute has been careful to take no action which would leave it open to criticism, and I have no complaint to make of this policy, but I do suggest that in matters of public interest and importance an unbiased expression coming from The Institute might carry a great deal of weight and might be of benefit to The Institute at large. In every branch visited, I have stressed the importance of the engineer taking his place in public life and bringing himself before the public, and I should hardly be consistent if I did not urge The Institute to do the same.

The year 1926 has, in a way, been a disappointment in the West. Heralded as a year in which industry was to make great strides and prosper, it has come below our expectations. The province of Quebec is developing very rapidly, hydro plants being developed and pulp plants built, but this prosperity has not yet extended to all of Canada. This state of things is largely accounted for by the disturbed state of the country politically. Now that we have a government that is stable and can carry on for its full term, I believe conditions will change. The general opinion throughout the country is that prosperity is at hand and we are due for a period of what is commonly called "good times," which will afford employment for our members and will tend to the prosperity of The Institute.

As Council's Report points out, our membership has not increased during 1926; rather, it has fallen slightly. The reasons for this are two-fold: firstly, that in times like these the engineer finds it hard to pay two sets of fees, one to The Institute and the other to the Association of Professional Engineers to which he belongs; and, secondly, to the fact that this year Council has adopted a vigorous policy of "weeding out" those members who were in arrears. The net result of this has been that, while the membership is numerically less, it is actually stronger. A determined canvass should be made in all our branches for members among those engineers who, while living and practising in Canada, have never joined The Institute.

During the last year I have been amazed to learn to what extent engineers are taking part in commercial life. The tendency in large corporations in the United States and in some large railroad organizations has been to choose as executive officers men who have been trained as engineers. I prophesy that more and more will this be the case.

I would suggest to the membership at large that, instead of thinking only of things as engineers have in the past been in the habit of thinking of them, they view them from a wider standpoint; that they see the engineer not ultimately as a man who rises to the top of his profession only on the technical side, but as one who is capable of rising to any position in the commercial field. I take it as a great tribute to me and an acknowledgment of the point of view that I am setting forth, that The Institute should honour me by making me its President, because, for the last twenty-five years I have myself been in commercial life. It is true that my commercial life has been closely associated with engineering, but I have been acting more in an executive capacity than as an engineer. Personally, I think the rewards and emoluments of executive work are greater, and if the engineer can get this outlook and keep his eye fixed on the higher positions, it will mean that not only will his chances of reaching such a position be increased, but he will at once augment the influence of the profession of which he is a member.

The Report of Council calls attention to the losses we have suffered this year by death. I might especially mention—Past-Presidents Gamble, Murphy and Anderson, also Sir Alexander Bertram, Treasurer of The Institute for years, and a staunch and loyal friend not only to The Institute but to all engineers.

I should not like to leave office without expressing my appreciation of the work which Council has accomplished during the past year. I am not sure that the membership at large realize the amount of work that is required of Councillors in the conduct of Institute affairs. The Secretary, also, has been indefatigable in his work and zealous for the welfare of The Institute.

In conclusion, may I again express my appreciation of the great honour that you have done me in electing me to a position, the highest in the gift of The Institute. My only regret has been that geographical conditions have prevented me from taking a more active part personally in the deliberations of Council, but I can assure you that my interest in the affairs of The Institute will not wane, and I hope to be as active, and of far more use to The Institute, in the future than I have been in the past.

PERSONALS

J. Owen O'Sullivan, A.M.E.I.C., is assistant engineer with the Harbour Commissioners of Quebec.

A. J. M. Bowman, A.M.E.I.C., has recently been elected president of the Cadwell Sand and Gravel Company, of Windsor, Ont.

A. D. Campbell, M.E.I.C., formerly assistant manager, O'Brine Mine, Cobalt, has moved to Bestel, Ont., where he is manager of the Castle-Trethewey Mines, Limited, of Gowganda.

G. W. Coward, A.M.E.I.C., who was formerly assistant to the chief engineer of the Entre Rios Railways Company and the Argentine North Eastern Railway Company at Concordia, has been appointed divisional engineer for the Entre Rios Railways with headquarters at Basavilbaso.

A. Donaldson, J.E.I.C., who was with Burns McDonell Engineering Company, Los Angeles, California, has moved to Idaho Falls, Idaho, where he is engaged as engineer with H. L. Stevens and Company on the construction of a large hotel.

A. C. Penman, A.M.E.I.C., who until recently was Montreal manager for W. S. Lee, M.E.I.C., vice-president and chief engineer of the Quebec Development Company, Limited, is now associated with Henry L. Doherty and Company, 60 Wall Street, New York City, in an engineering capacity.

R. N. Geary, S.E.I.C., who for some years has been on the engineering staff of the Hydro-Electric Power Commission of Ontario at Niagara Falls, Ont., has joined the General Motors Corporation, Oshawa, in the office of plant records and appraisal department.

J. B. Pringle, S.E.I.C., assistant cable engineer of the Northern Electric Company, Limited, at Montreal, has joined the staff of the United Electric Light and Power Company, and is at present engaged on the new 132-kv. Pirilli cable installation between Hell Gate and Dunwoodie.

C. A. Mullen, M.E.I.C., director of paving department and chief consulting engineer of the Milton Hersey Company, Limited, was re-elected secretary-treasurer of the Association of Asphalt Paving Technologists at the society's recent annual meeting at the LaSalle Hotel, Chicago, on January 13th, 1927.

Allan T. Bone, A.M.E.I.C., who was formerly assistant superintendent and later superintendent for the Geo. A. Fuller Company, Limited, on the construction of the Metropolitan Life Insurance Building, Ottawa, has been transferred to Montreal, where he is acting as assistant superintendent on the construction of the new Royal Bank Building.

F. H. Cothran, M.E.I.C., formerly vice-president of the Quebec Development Company and in charge of construction on the Saguenay river projects, has been appointed chief engineer of the Piedmont and Northern Lines with office on the fifteenth floor of the Johnston Building, Charlotte, N.C.

Perry A. Borden, A.M.E.I.C., has been appointed research and development engineer with The Bristol Company, Waterbury, Conn. Mr. Borden graduated with honours in electrical engineering from Queen's University in 1911, and was for a number of years in charge of electrical meters and standards with the Hydro-Electric Power Commission of Ontario.

Alex. Ritchie, A.M.E.I.C., secretary-treasurer of the Edmonton Branch of The Institute and technical engineer of the power plant department of the city of Edmonton, has resigned to accept the position of service and research engineer with the Riley Engineering and Supply Company of Toronto. Mr. Ritchie is a native of Scotland and came to Canada in 1913, when he first entered the employ of the city of Edmonton as draughtsman. The following year he was placed in charge of the city of Edmonton's filtration plant, continuing in this position until 1919, when he was appointed to the position from which he has just resigned.

D. E. McPherson, A.M.E.I.C., who has been field engineer with H. H. Carrothers, Inc., engineers and constructors, Kansas City, Mo., during the construction of the memorial stadium for the University of Missouri at Columbia, Mo., has been transferred to the company's head office, where he will be engaged as engineer and estimator. Mr. McPherson is a graduate of the University of Manitoba of the year 1916, and following graduation he was for two years assistant engineer with the Winnipeg Aqueduct Construction Company and for a number of years he was on the engineering staff of the Canadian National Railways, both at Winnipeg and Eston, Sask.

J. R. Ross, Jr.E.I.C., who has been with the Provincial Forestry Air Service with headquarters at Sault Ste. Marie, Ont., for the past few years, has resigned from that service and leaves to join H. A. Oakes, Jr.E.I.C., at Hudson, Ont. They are going to operate the Western Canada Airways Service, with headquarters at Hudson, on the Canadian National Railways, about twelve miles west of Sioux Lookout. They will use two planes with a capacity of five passengers each or freight equivalent, these planes to operate between Hudson and Red Lake. Mr. Oakes was formerly with the Provincial Forestry Air Service, but resigned last year to organize the company with which he is now connected.

R. F. Howard, M.E.I.C., Joins Gatineau Power Company

R. F. Howard, M.E.I.C., has been appointed manager of power sales with the Gatineau Power Company with headquarters at Ottawa.

Mr. Howard, who is a graduate of McGill University of the year 1901, after completing the student course at the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., spent four years in the construction department of the same company. In 1901 he was transferred to the Canadian Westinghouse Company at Montreal as district engineer, having charge of all engineering work for the company from Ottawa to the Maritime provinces.

Subsequently, he was in charge of the company's work at the city of Winnipeg hydro-electric plant and in 1917 was attached to the company's Winnipeg office as commercial engineer, but later resigned to accept the position of chief engineer of the British American Nickel Corporation at Ottawa, where he remained until 1921, when he became connected with Messrs. Kerry and Chace Limited, consulting engineers, Toronto, as assistant in connection with investigating and reporting on the proposed electrification of the Temiskaming and Northern Ontario Railway. In 1922 he entered private practice.

City Engineer of Sault Ste. Marie

A. H. Russell, A.M.E.I.C., secretary-treasurer of the Sault Ste. Marie Branch of The Institute, has been appointed city engineer of Sault Ste. Marie.

Mr. Russell was assistant city engineer from 1921 until July 1926, when he was appointed acting city engineer. He is a native of Renfrew and attended McGill University. In

A. H. RUSSELL, A.M.E.I.C.

E. R. SHIRLEY, M.E.I.C.

1909 he went to Sault Ste. Marie and joined the staff of the Lake Superior Power Company in the meter and operating department. In 1913 he became assistant to the field engineer of the water power department of the Algoma Steel Corporation, Limited, and two years later was appointed senior operator of the hydro-electric plant for this company. In 1916 he became connected with the Spanish River Pulp and Paper Company, engaged principally in field work, and two years later was promoted to assistant to the resident engineer of the same company.

E. R. Shirley, M.E.I.C., Elected to Peterborough Utilities Comission

Much has been said and written with a view to encouraging members of The Institute to take a greater interest in civic affairs in their respective localities, and the members will be interested in the announcement that at the municipal elections in Peterborough, Ont., held January 1st, 1927, E. R. Shirley, M.E.I.C., was elected to a seat on the Peterborough Utilities Commission. This is all the more gratifying in view of the fact that there were five candidates for one vacancy, including one ex-mayor and one ex-alderman, and that Mr. Shirley obtained a substantial majority.

Mr. Shirley holds the degree of B.A. with honours from the University of New Brunswick, received in 1903, and B.Sc. with honours from Queen's University, 1912. In the interval between his university courses he spent the years 1903-1909 and the summers of 1910 and 1911 with the Canadian General Electric Company, Peterborough.

From 1912 to 1913, Mr. Shirley was assistant superintendent of the British Canadian Power Company and Northern Ontario Light and Power Company, of Cobalt, Ont., and from 1913 to 1915 was electrical superintendent of the Canadian Exploration Company. He was then appointed superintendent of the Laurentian Power Company at Beaupré, Que., with which he served from 1915 to 1917. Since the latter date, Mr. Shirley has been in the switchboard engineering department of the Canadian General Electric Company, Peterborough.

It might be mentioned that this is the first occasion on which an engineer has stood for a position on the local

Utilities Commission since C. E. Sisson, M.E.I.C., moved to Toronto some years ago, but with the realization of the advantages of having a technically trained man as representative on the Utilities Commission, there is little doubt of the future election of any engineering candidate who may be proposed.

A. B. NORMANDIN, A.M.E.I.C.

A. B. Normandin, A.M.E.I.C., chairman of the Quebec Branch since 1925, and recently elected member of Council representing the Quebec Branch, was chairman of the Executive Committee in charge of arrangements for the Annual General Professional Meeting recently held in Quebec.

Mr. Normandin is assistant chief engineer of Hydraulic Service for the province of Quebec. He was born at St. Constant, county of Laprairie, Que., in 1883 and received his primary education at the Elementary School and Ecole Normale Jacques-Cartier, entering Laval University, Polytechnique School, in 1903, and graduating with the degree of B.Sc. in civil engineering in 1907. Following graduation he was engaged on municipal work and land survey until 1909, when he became city engineer of Three Rivers. In 1911 he became engaged with a firm of consulting engineers for La Compagnie de Pulpe de Chicoutimi, Le Chemin de Fer de la Baie des Ha! Ha!, La Compagnie du Havre de Chicoutimi and the town of Chicoutimi, following which he was appointed to his present position.

He is a member of the Corporation of the Quebec Land Surveyors, and was elected an Associate Member of The Institute in 1912.

A. B. NORMANDIN, A.M.E.I.C.

W. G. MITCHELL, M.E.I.C.

S. L. deCARTERET, M.E.I.C.

W. G. MITCHELL, M.E.I.C.

W. G. Mitchell, M.E.I.C., was chairman of the Finance Committee and Technical Papers Committee in connection with the Annual General Professional Meeting at Quebec. Mr. Mitchell is a vice-president of The Institute and was the first chairman of the Saguenay Branch. He is a native of Port Hope, Ont., where he was born on July 25th, 1888. He received his degree of B.Sc. in 1913 and that of M.Sc. in 1914 from McGill University.

From 1914-1916 he was in charge of the division of wood preservation for the Forest Products Laboratories, Montreal, and for the next three years he was with R. Martens and Company, Limited, of London, England, as mining engineer on the investigation of timber and mining industries in Scandinavia, Finland, European Russia, Serbia and Manchuria. During the latter part of 1919 he was engaged in private practice in Canada and the United States, following which he was appointed special technical representative of the Canadian Export Paper Company, Limited, Montreal. In March 1921 he became associated with Price Brothers and Company, Limited, and early in 1922 took charge of the operation of the company's pulp and paper mills as assistant to the president.

S. L. DECARTERET, M.E.I.C.

S. L. deCarteret, M.E.I.C., of the Hammermill Paper Company, Quebec, was chairman of the Reception and Entertainment Committee of the Annual General Professional Meeting at Quebec. Mr. deCarteret is a native of Auckland, New Zealand, where he was born on November 24th, 1885, and is a graduate of Yale University, from which he received the degree of Ph.B. in civil engineering in 1908.

His early engineering work, following his graduation from Yale, was with the Riordon Paper Company, with which company he was engaged on topographic and forest surveys and in charge of office work in connection with same. In 1910 he joined the Brown Corporation, being in charge of the department in connection with topographic and forest surveys and in charge of office work in connection with same. In 1910 he joined the Brown Corporation, being in charge of the department in connection with topographic and forest surveys and investigations of water supply and water storage for power purposes. Two years later, with the same company, he was engaged on the design and construction of dams, piers, etc., on the Ste. Anne river, Portneuf county, and subsequently on the construction and operation of the loading plant and private sidings at St. Casimir; the operation of the company's private railway and electric plant, Upper St. Maurice river, and the design and construction of various works at Bersimis, Saguenay county. In 1923 he joined the Hammermill Paper Company, and has been in charge of the company's properties and operations in the province of Quebec since that date.

L. C. Dupuis, A.M.E.I.C.

L. C. Dupuis, A.M.E.I.C., who was chairman of the Excursion Committee of the Annual General Professional Meeting in Quebec, is division engineer, maintenance-of-way and betterments, Levis Division, Canadian National Railways, Levis, Que. He was born in St. Roch des Aulnaies, County of L'Islet, Que., on November 8th, 1886. His education was received at Laval Normal School and Laval University Survey School and by private tuition.

His early work was in connection with land and timber surveys, and in 1911 he became assistant engineer with the Intercolonial Railway at Moncton, N.B., continuing the following year in the same position at Levis, Que. He has remained at Levis practically ever since occupying successively the positions of resident engineer with the Intercolonial Railway, engineer on double tracking, assistant engineer with the Canadian Government Railways and division engineer of the Saguenay Division, Canadian National Railways, and later in 1924 division engineer of the Levis Division of the Canadian National Railways.

L. C. DUPUIS, A.M.E.I.C.

HECTOR CIMON, A.M.E.I.C.

LOUIS BEAUDRY, A.M.E.I.C.

Hector Cimon, A.M.E.I.C.

Hector Cimon, A.M.E.I.C., formerly secretary-treasurer of the Quebec Branch, was chairman of the Registration, Publicity and Printing Committee at the Annual General Professional Meeting at Quebec, and is engineer of the Lands Department of the South Shore Logging Division with Price Brothers and Company, Limited, at Quebec. He was born at Rivière du Loup, county of Témiscouata, Que., on April 28th, 1893. His early education was received at the Quebec Seminary and Laval University at Quebec, from which he received the degree of B.A., completing his studies at Ecole Polytechnique, Montreal, with the degree of B.A.Sc. in civil engineering. In 1916 he joined the company with which he has remained ever since and was placed in charge of special surveys for the company.

He joined The Institute in 1912 at Student and was transferred to Associate Member in 1919. From 1921 to 1924 he was secretary-treasurer of the Quebec Branch.

Louis Beaudry, A.M.E.I.C.

Louis Beaudry, A.M.E.I.C., is secretary-treasurer of the Quebec Branch of The Institute, under whose auspices the recent Annual General Professional Meeting was held at Quebec.

Mr. Beaudry was born at Three Rivers, Que., on June 19th, 1897, and graduated from Ecole Polytechnique with the degree of B.A.Sc. in civil engineering in 1921. His work prior to graduation was with the Roads Department, province of Quebec, and with the city of Outremont.

For two years following graduation Mr. Beaudry was engaged on construction work under the firm name of Trepanier and Beaudry at Three Rivers. In February 1923 he joined the engineering staff of the Department of Public Works of the province of Quebec, with which he was engaged on the location, design and inspection of bridges, until accepting his present position with Messrs. Wm. I. Bishop Company, Limited, on the construction of the Anglo-Canadian Pulp Company's mill at Limoilou, Que., the latter part of 1926.

Committees in Charge of Arrangements

The committees of the Quebec Branch in charge of the arrangements were:—

Executive Committee

A. B. Normandin, A.M.E.I.C., *Chairman*	L. C. Dupuis, A.M.E.I.C.
Louis Beaudry, A.M.E.I.C., *Secretary*	T. J. F. King, A.M.E.I.C.
A. R. Decary, M.E.I.C.	A. Lariviere, A.M.E.I.C.
H. Cimon, A.M.E.I.C.	T. E. Rousseau, M.E.I.C.
S. L. deCarteret, M.E.I.C.	W. G. Mitchell, M.E.I.C.

Finance Committee

W. G. Mitchell, M.E.I.C., *Chairman*	S. L. deCarteret, M.E.I.C.
A. B. Normandin, A.M.E.I.C.	

Reception and Entertainment Committee

S. L. deCarteret, M.E.I.C., *Chairman*	J. A. Duchastel, M.E.I.C.
A. Amos, A.M.E.I.C.	R. L. Seaborne, A.M.E.I.C.

Registration, Publicity and Printing Committee

H. Cimon, A.M.E.I.C., *Chairman*	A. Lariviere, A.M.E.I.C.
H. Gauthier, A.M.E.I.C.	J. G. O'Donnell, A.M.E.I.C.

Excursion Committee

L. C. Dupuis, A.M.E.I.C., *Chairman*	T. J. F. King, A.M.E.I.C.
A. Dick, A.M.E.I.C.	T. E. Rousseau, M.E.I.C.
A. Lafleche, A.M.E.I.C.	

Ladies' Committee

Madame S. L. deCarteret, *Chairman*	Madame A. B. Normandin
" A. Amos	" H. Cimon
" J. A. Duchastel	" E. W. Gauvreau
" W. G. Mitchell	" R. L. Seaborne

Technical Papers Committee

W. G. Mitchell, M.E.I.C., *Chairman*	H. Cimon, A.M.E.I.C.
F. X. Ahern, A.M.E.I.C.	

Newly-Elected Vice-Presidents of the Institute

J. H. Hunter, M.E.I.C., whose election as vice-president of The Institute was announced at the Annual Meeting in Quebec on February 15th, is general superintendent of the Canada Starch Company.

Mr. Hunter has been a member of the Council of The Institute for the past two years, and during 1926 he was chairman of the Finance Committee. He is a native of Sorel, Que., where he was born on April 29th, 1865. He commenced his engineering work in 1881 with the Canadian Pacific Railway Company, and in the following year was on the engineering staff of the Montreal Harbour Commissioners. From 1885-87 he was with Wood Saxon and Company, hydraulic and electrical engineers, in New York, following which he was engaged on railway construction with the Baltimore and Ohio and Staten Island Rapid Transit Railway in connection with electric block signal installation. In 1893 he was with the Danbury Electric Light and Power Company and in the following year entered private practice.

J. H. HUNTER, M.E.I.C.

During his period of private practice as consulting engineer, he was responsible for the design and construction of a great many works, principally in the province of Quebec, among which are: Boston Rubber Company, St. Jerome; St. Jerome Electric Light Company; North River Power Company; Wiarton Binder Twine Company; Waterville Electric and Power Company; plans for Sault St. Louis Light and Power Company; unloading plant and coal pockets for Dominion Coal Company; Cardinal Electric Light and Power Company; Fort William Starch plant; concrete dock and grain elevator at Fort William; rebuilding of Canada Starch Company plant, Cardinal; and a number of reinforced concrete industrial buildings and other concrete structures. He was also engineer to the Canada Starch Company, St. Paul Land and Hydraulic Company and concreting engineer to Corn Products and Refining Company.

Sam G. Porter, M.E.I.C., assistant manager, Department of Natural Resources, Canadian Pacific Railway, at Calgary, Alta., has been elected vice-president of The Institute, representing Zone A.

Mr. Porter was born at Kyle, Texas, U.S.A., on September 1st, 1875, and received his early education at a private school in his home county, later entering Baylor University at Waco, Texas, from which he received the degrees of B.A. and M.A. Following graduation from Baylor University, he taught school in Texas for several years, subsequently entering the Massachusetts Institute of Technology, from which he graduated in civil engineering. He then entered United States Reclamation Service and was engaged on the preliminary and location surveys in the states of New Mexico, Colorado, Nebraska and Wyoming, during which time he was in charge of part of the construction programme of the inter-state canal between Wyoming and Nebraska. He later became chief engineer of the Arkansas Valley Sugar and Irrigated Land Company at Holly, Colo.

SAM G. PORTER, M.E.I.C.

In 1913 he was appointed inspection engineer for the Dominion government in Alberta in connection with the irrigation office of the Department of the Interior. He was later promoted to the position of assistant chief engineer and acting irrigation commissioner. Mr. Porter's next change was from the government service to the employ of the Canadian Pacific Railway, becoming superintendent of operation and maintenance of the southern section of the Canadian Pacific Railway system in 1918 with headquarters at Lethbridge, and, under his administration, many new works have been carried out.

Mr. Porter has taken a very active interest in the affairs of the Lethbridge Branch, and was for three years, 1921-1923, on the Council of The Institute. He has also been a member of Council and vice-president of the Association of Professional Engineers of Alberta.

OBITUARIES

Col. W. P. Anderson, C.M.G., M.E.I.C.

The engineering profession in Canada lost one of its outstanding members and The Institute one of its original members when death claimed Colonel William Patrick Anderson, C.M.G., V.D., F.R.G.S., M.INST.C.E., M.E.I.C., chief engineer and superintendent of lighthouses in the Department of Marine and Fisheries up to seven years ago. Colonel Anderson's death occurred at his home, 64 Cooper street, Ottawa, on February 1st, 1927, following an illness of about six weeks' duration. He was seized with an attack of angina pectoris on December 15th last, from which he failed to rally.

Few men can boast the wide and varied connections and interest which Colonel Anderson had cultivated during his lifetime. Not only in military circles of the city was he a prominent figure, but in engineering, geographical survey work and marksmanship he was one of the leaders of the Dominion. He was also well-known locally as a golfer, curler, naturalist and as a stamp collector.

But his greatest reputation is that of an engineer, and throughout the Dominion 500 lighthouses and 50 fog alarm stations stand as evidence of the efficient effort which he placed in his work in the Civil Service, controlling as he did all construction work in connection with aids to navigation and most of the technical work of the Department of Marine and Fisheries.

Colonel Anderson was born in Levis, Que., on September 4th, 1851, the eldest son of Thomas Anderson, late Crown lands and timber agent at Edmonton, Alberta, and Adelaide A. Smyth. He was educated at Bishop's College, Lennoxville, and Manitoba College, Winnipeg. In 1872 he went to the north country as an apprentice to a land surveyor, and there was introduced into practical survey work.

In 1874 he came to Ottawa, and entered the Civil Service as a draughtsman in the Department of Marine and Fisheries. He rose quickly, soon became assistant engineer, and in 1880 became chief engineer and superintendent of lighthouses, which post he held until 1919, when he was superannuated.

Colonel Anderson always took an active interest in military matters, and was at one time commanding officer of the 43rd Regiment. His military career began while he was attending college. When only thirteen years of age he entered the militia, in 1864, and interrupted his college education to serve in the ranks during the Fenian Raid of 1886. He served in the second raid, a few years later, also.

When he came to Ottawa in 1874, he joined the Governor-General's Foot Guards, and remained with that unit until 1881, when, upon the organization of the 43rd Ottawa and Carleton Rifles, he was transferred as an adjutant. He commanded the regiment with the rank of a lieutenant-colonel from 1882 to 1892. He retired from the command of the 43rd Regiment, but remained on the active militia list until about two years ago. In 1885 he established the Canadian Military Gazette, and edited it for two years.

He was an excellent rifle shot, and always took a great interest in shooting. At one time he was chairman of the Small Arms Committee of Canada, and was on the council of the Dominion of Canada Rifle Association and a life governor. In 1900 he won the Governor-General's prize at the D.C.R.A. meet at Rockliffe Park Rifle Ranges, and was on one occasion a member of the Canadian Bisley Team, and in 1904 was commandant of the team, during which

COL. W. P. ANDERSON, C.M.G., M.E.I.C.

year Perry, of the Canadian team, captured the King's Prize, the highest individual shooting award in the British Empire. From 1919 until last year he was treasurer of the D.C.R.A.

Colonel Anderson was one of the first members of The Canadian Society of Civil Engineers and assisted in its organization, his membership dating from January 20th, 1887, prior to the incorporation of the Society. He was councillor during the years 1890, 1891 and 1901, and vice-president in 1902. In 1904 he was president of the Society, and was always one of the most prominent and enthusiastic members of the Society, as well as of The Engineering Institute of Canada which succeeded it. In 1906 he was elected a fellow of the Royal Geographical Society, and also was a member of the Institute of Civil Engineers of Great Britain. Until recently he was chairman of the Geographical Board of Canada. On January 1st, 1913, in the King's New Year's honour list, he was created a C.M.G.

Colonel Anderson was one of the founders of the Ottawa Field Naturalists' Club. In 1885 he was president of the Ottawa Literary and Scientific Society. In 1898 he became public school trustee for Central ward, and continued on the board for many years, occupying the position of chairman in 1906. He later was a member of the Collegiate Institute Board for many years. An enthusiastic curler, he was one of the originators of the Rideau Curling Club. He also was a member of the Rideau Club for many years, and of the Royal Ottawa Golf Club. He was one of the best known stamp-collectors in Canada, specializing in British North America stamps.

On October 18, 1876, he married Dorothea S. Small, daughter of the late H. B. Small, secretary of the Department of Agriculture. Last year they celebrated their golden wedding anniversary, five children and ten grandchildren, the entire family, being present.

The funeral of the late Colonel Anderson was held at St. George's Church, Ottawa, interment taking place in the family plot at Beechwood Cemetery. The large congregation, numbering in the neighbourhood of 1,000 persons, and including many men prominent in the affairs of the Capital, bore evidence of the high esteem in which the deceased was held.

Representatives of many organizations, some outside of Ottawa, were on hand to pay their last tribute to an esteemed fellow-member. These included many professional and military societies in the affairs of which Colonel Anderson had taken a leading part. The cortege included many members of the Engineering Institute of Canada, Headquarters being represented as well as the Ottawa Branch.

Robert Clarence Forbes, S.E.I.C.

Deep regret is expressed at the news of the death of Robert Clarence Forbes, S.E.I.C., which occurred at the Montreal General Hospital on February 13th, 1927.

The late Mr. Forbes was born at Westmount, Que., on January 15th, 1902, and received his early education at the public and high schools of Westmount and his degree of B.Sc. from McGill University in 1924.

During the summer months of his university course, he was employed for three months in 1922 with the Hollinger Consolidated Gold Mines Limited as mechanical draughtsman and for two months in 1923 with the E. G. M. Cape and Company as assistant engineer on water works contract, Verdun, and was still engaged with this company at the time of his death.

Mr. Forbes joined The Institute as Student on October 29th, 1923.

Edgar Augustus James, M.E.I.C.

It is with regret that we record the death of Edgar Augustus James, M.E.I.C., which occurred at Toronto on February 12th, 1927.

The late Mr. James was born at Thornhill, Ont., on August 25th, 1875, and graduated from the University of Toronto with the degree of B.A.Sc. in 1905. During the summer vacations of his university course he was engaged as follows:—resident engineer, Drainage District No. 6, Manitoba, in 1902; and assistant district engineer, McLeod District, North West Territories, on irrigation, bridges, etc., in 1903.

The first three years after graduation were spent with the Canadian Pacific Railway Company as resident engineer on construction on the Sudbury branch, and for the next year he was editor of the "Canadian Engineer." From 1910-11 he was town engineer of North Toronto in charge of pavements, electric light construction, sewers and sewerage disposal works, water works, etc., and the following year was chief engineer of the York Highway Board and also consulting engineer for New Toronto, Leaside, Grand Valley Railway. In 1914 he entered private practice in Toronto as senior partner in the firm of James, Proctor and Redfern, and has since been identified with many municipal works throughout the province.

Mr. James joined The Institute as Student on April 23rd, 1903, transferred to Associate Member on May 2nd, 1907, and to Member on May 16th, 1914.

Meeting of Council

Meeting of February 8th, 1927

A meeting of Council was held at eight p.m. on Tuesday, February 8th, 1927, Vice-President K. B. Thornton, M.E.I.C., in the chair, and eight members of Council being present.

The following appointments were made:—Mr. J. A. Burnett, M.E.I.C., was unanimously appointed chairman of the Nominating Committee, and Professor R. deL. French, M.E.I.C., was unanimously appointed chairman of the Board of Examiners and Education.

A unanimous vote having been received from the Councillors, the Secretary was directed to request the new Governor-General, Lord Willingdon, to honour The Institute by becoming an Honorary Member.

With reference to the proposal to initiate discussion as to the best method to bring about substantial uniformity in the requirements of admission by examination to the seven provincial associations and to The Institute, the Secretary reported receipt of a reply from Mr. F. B. Brown to the letter which by direction of Council at the January meeting had been addressed to him, stating that this communication had been brought to the attention of the various governing bodies of the provincial associations. It was decided to refer the matter to the incoming Council for special consideration.

A communication was read from the St. John Branch of The Institute, stating that that branch had passed a resolution offering the co-operation of a committee to work with the St. John Board of Trade on any engineering problem of local or civic interest, which offer had been gratefully accepted. This was noted with approval by Council.

The Secretary reported the death of Colonel W. P. Anderson, which was noted with deep regret by the Council, and the following resolution was unanimously passed, the Secretary being directed to communicate it to the family of the late Colonel Anderson:—

> The Council of the Engineering Institute of Canada has learned with deep regret of the death of Colonel W. P. Anderson, C.M.G., and desires to convey to his family its sincere condolence on their bereavement.
>
> An active member of the small group of engineers who were originally concerned in the formation of the Canadian Society of Civil Engineers, he rendered invaluable service to the profession in building up that organization, in which he served successively as Councillor, Vice-President and President, always maintaining his interest in professional affairs, and aiding The Institute with his wise judgment and advice.
>
> The Council of The Institute places on record its appreciation of this service and The Institute's indebtedness to the eminent engineer who has passed away.

The report of the Committee on Biographies was submitted and approved.

Five requests for reinstatement were considered and approved, and ten resignations were accepted.

Ten applications for admission and transfer were scrutinized and classified for the ballot returnable March 22nd, 1927.

Three special cases were considered in connection with applications for admission.

The Council rose at ten-twenty o'clock p.m.

Engineers in Insurance Work

In connection with the statement, which is frequently made, that an engineering training fits a man for other spheres of work than that usually considered as engineering, attention may be drawn to the announcement appearing under the employment bureau column in this issue of the Journal, referring to the employment of engineers on special work in connection with one of our large life insurance companies. It is interesting to note that, in this apparently unrelated sphere, an engineer's special qualifications which, through his training, are reflected in his character and outlook, are being recognized in this manner.

It has recently been learned that in this particular line of work several graduates in engineering have received rapid promotion and that the policy inaugurated has yielded satisfactory results in practice.

There are, undoubtedly, a number of members of The Institute holding positions which offer small prospects of promotion who would be interested in such a proposition, and for this reason attention is directed to the notice referred to above.

ABSTRACT OF PAPER

The Hemmings Falls Power Development

S. H. Wurtele, M.E.I.C., Vice-President and Plant Manager, The Southern Canada Power Company, Limited

Peterborough Branch, January 27th, 1927

The Hemmings Falls power site, two and one-half miles above Drummondville, is at a point where a fifteen-foot fall terminated a series of rapids in which there was a total drop of fifty feet in a five-mile stretch of the river. There were favourable conditions in banks and riverbed at this point, and a practical scheme of development was evolved consisting essentially of a north wing wall, power house section, sluiceway section, spillway and south wing wall, together with an isolated earthfill dam.

In this scheme two of the principal considerations which determined the exact location of the power house were, that a natural declivity could be enlarged to afford a well protected tailrace without excessive excavation, and advantage could be taken of an opportunity to so place the gatehouse that it would be exposed to the morning sun in winter time.

CONSTRUCTION

A contract for the construction of the complete development was awarded to the Foundation Company of Canada, Limited, on September 1st, 1923. Two weeks later work was under way on a three-mile siding from the main line of the Canadian National Railway. This siding was ready for operation November 15th, by which time a temporary coffer dam had been built and the power house site and tailrace were well under way by December 18th, at which time a more or less expected ice barrage formed in the river below the tailrace, gradually drowned out the work, and necessitated abandoning this part of the excavation until April 15th, 1924. The river, loaded with frazil ice, rose to over fifteen feet above normal level. It is interesting to note that since the construction of the dam there has not been any trouble from frazil ice at the Drummondville power house, and that during the past winter there has not been any ice barrage or winter rise of tailrace water level at Hemmings Falls.

Excavation work was carried on throughout the winter at the site of the north wing walls, and some 3,000 cubic yards of concrete were poured at this point as a try-out for the concreting plant and other items of equipment. Other than this no actual work could be done before the middle of April, 1924, when the temporary cofferdam was again unwatered and rock excavation resumed. By May 20th actual concreting operation started and thereafter work was carried to completion with only one short delay.

The major items in the work were as follows: 62,000 cubic yards rock excavation, 108,000 cubic yards of earth excavation and embankment, 80,000 cubic yards of concrete, 530 tons of reinforcing steel, 530 tons of structural steel for buildings, 1,175,000 bricks.

All concrete from the mixers was handled by means of trains, hauled by gasoline locomotives, operating on a trestle with track elevation eighteen inches above the crest of the bulkhead sections of the dam. Each concrete train consisted of two cars and carried four cubic yards of mixed material. The trestle was about 2,000 feet in length, with a maximum height of 60 feet, and was located on the upstream face of the dam. Concrete was deposited into all parts of the work direct from this trestle, using short lengths of chutes and hoppers fixed to the trestle stringers. With these facilities, concrete could be placed at any number of different places during a single day's run without the usual delays incident to changing hoppers and chutes. It was also possible to carry on form work at a number of places simultaneously.

All reinforcing steel was bent on the job. Rail carbon steel was used for straight rods and medium steel for bent rods. The number of different sizes was kept to a minimum, and to avoid mixing the two grades in the field, the hard steel was carried in rounds and the medium steel in squares.

All construction plant was motor driven with the exception of steam shovels, locomotive crane and gasoline locomotives. Power was delivered to the site at 2,300 volts and stepped down to 550 volts for distribution to individual motors. The connected motor load was 800 horse power.

Fifteen hundred cubic feet per minute of air was provided for rock drills and other pneumatic equipment. The maximum force employed was 750 men.

A noteworthy feature of the construction work was the short time taken to pour the river bed section, some 950 feet long. Concreting of this portion started May 20th. By July 10th the upstream coffer dam in the deep water channel had been completed and the river diverted through temporary sluices left in the spillway section adjacent to the power house. A downstream coffer dam was built in the deep water channel. By August 1st excavation for the base of the dam at this point had been completed and concrete had been placed. In ten weeks the river had been completely coffer dammed, the flow diverted, the bed rock and cut-off trenches prepared, and concrete had been placed across 950 feet of river bed.

Saskatchewan Power Enquiry Commission

Recognizing the need for a fresh survey of the power situation in the province, the Saskatchewan government has by Order-in-Council appointed a Power Enquiry Commission. The personnel of the commission is: L. A. Thornton, M.E.I.C., city commissioner, Regina, chairman; Arthur Hitchcock, Moose Jaw; Prof. A. R. Greig, M.E.I.C., Saskatoon; with R. N. Blackburn, M.E.I.C., secretary to the commission.

The commission has been created on the advice of the minister in charge of the Bureau of Labour and Industries and has the power to summon witnesses and compel their attendance and the giving of evidence.

The commission is charged with inquiring into and reporting on the economic practicability of generating power at central power plants and water power sites in the province and the distribution of power throughout the province.

Particular mention is made of the following points of inquiry:—

Central power plants on the lignite fields of southern Saskatchewan.

Central power plants at other suitable points with a view to their ultimate interconnection.

Production of char, briquettes and other by-products at central plants.

Cost of power at central plants, economic limits of transmission and probable selling price of power at different points.

Existing power plants and their output, cost of production and selling price of current.

The tendency toward the use of electricity on farms already adjacent to power lines and the likelihood of creating a demand for power in farming communities.

Advisability of using existing pole lines for transmission in rural localities.

Advisability of municipalities selling power outside their corporate limits.

Hydro-electric possibilities.

Suitable type of transmission and distribution lines.

Present and possible future market for power.

The commission will very shortly hold an organization meeting for the purpose of planning the future steps of the enquiry.

Saskatchewan already produces large quantities of all agricultural products and is also rich in clay products in the south and minerals in the north. Any step towards increased manufacturing in the province would have a very beneficial effect on the industrial life of the whole province, particularly with regard to giving employment throughout the year.

Horn Shaped Shifting Sand Dunes.

C. B. R. Macdonald, A.M.E.I.C., who has been engaged on railway construction in the northern part of Peru, in a message extending New Year's greetings to all members of The Institute, submits the above interesting photograph showing the famous horn shaped shifting sand dunes along the road of the Southern Railway of Peru.

BOOK REVIEWS

Interpolation

By J. F. Steffensen, Ph.D., The Williams and Wilkins Company, Baltimore, Md., 1927. Cloth, 6¼ x 9½ in., 248 pp., tables, $8.00.

It is a pleasure to welcome this translation of Dr. Steffensen's important work on the theory of Interpolation, written with all the distinguished author's customary clarity and conciseness. The treatment is really elementary and requires merely a knowledge of the elements of the Differential and Integral Calculus. The first hundred pages cover Displacement-Symbols and Differences, Interpolation Formulae, Numerical Differentiation, Construction of Tables, Inverse Interpolation and Summation; they are easily within the grasp of the ordinary engineering undergraduate. The latter half of the book is of greater difficulty. It includes Bernouilli's Polynomials, Mechanical Quadrature and Cubature, Numerical Integration of Differential Equations, Interpolation with several Variables and the Calculus of Symbols.

The author derives the usual interpolation formulae from the "divided difference" formulae, and later on by the same method shows how to extend Stirling's and Bessel's formulae to functions of two variables. The outstanding feature of the book is the expression of the remainder term as some one of the derivatives of f (x) (where x lies within the range of interpolation) multiplied by a factor. This fixes a higher limit to the error than by merely giving the first neglected difference. But in practice this is not so useful as it appears, for the fluctuation of the derivative may be so great that the maximum error gives no indication of the actual error—and, of course, the method will not apply to a series of numbers whose mathematical formula is unknown. The author himself says "the result of such an interpolation must, under the circumstances, be considered as an hypothesis and not as a mathematically proven fact."

Everybody who is interested in the practical application of mathematics should certainly read this book. Unfortunately, the high price is likely to militate against its adoption as a text-book, and also, from the point of view of the methods of teaching in English-speaking countries, the absence of examples to be solved is undoubtedly a disadvantage. Perhaps we may add that the book is a text, and not a work of reference.

H. Tate.

Practical Structural Design in Timber, Steel and Concrete

By Ernest McCullough Scientific Book Corporation, New York, 1926. Cloth, 6 x 9 in., 416 pages, 224 illustrations, $4.00.

The object of the author. as set forth in his preface, was to present the subject of structural design in a way that can be understood "by men whose knowledge of mathematics does not extend beyond that taught in High School." No attempt has been made to prove the formulæ used in the solutions. The author states in a simple manner the method of procedure in design, illustrating his discussion with suitable diagrams.

The book has evidently been well received, for it is now in the third edition, the first edition having been placed before the public in 1917. Known errors of the previous edition have been corrected and new material added, notably a treatment of reinforced concrete. The subject matter is set forth in easily read type and the diagrams are clearly drawn.

The book treats almost entirely of the problems that arise in building design. After discussing the action of forces in a general way, the design of beams, girders and trusses, joints and connections are taken up. Chapter 6, on graphic statics, is followed by chapters on columns and structures, semi-rigid frames, miscellaneous data and reinforced concrete. Typical examples of timber, steel, and reinforced concrete members are used to illustrate the principles set out in the text.

There is included much practical information, short cuts and hints on procedure, gleaned from the author's forty years' experience, which are not ordinarily found in more technical books on structural design.

For the structural draughtsman desirous of learning something of design, and for the engineer who has not specialized in structural design but who may be called upon occasionally to design structural members, this book, in the opinion of the reviewer, should be very helpful.

W. P. Copp, M.E.I.C.

Machine Design Problems

By S. J. Berard and E. O. Waters, D. Van Nostrand Company, New York, 1927. Cloth, 6 x 9 in., 118 pp., illus., $1.50 net.

This book of problems is intended as a supplement to the text "The Elements of Machine Design," by the same authors.

The general arrangement of the book is very convenient. The problems are arranged in chapters corresponding to the chapters in the textbook. Each chapter contains problems of three kinds, grouped separately, the first group comprising problems to be solved by calculation; the second, free hand sketching exercises; and the third, complete working drawings; the latter two based on dimensions to be calculated.

The problems are of such a type, and so arranged, as to develop the intelligence and reasoning ability of the student, while at the same time illustrating sound engineering practice and practical methods of computation and design. The examples cover all of the more common machine elements, fastenings, shafts, bearings, belts and gearing of various kinds, as well as cams, linkages, pistons and piping.

The use of the book of problems, in conjunction with the text, in teaching, will facilitate the assignment of suitable exercises to illustrate the principles developed during lectures or class instruction and familiarize the student with units and proportions. For the engineer who desires to brush up his machine design, or the student or mechanic seeking to improve his knowledge of the subject in home study, the selection and arrangement of the problems should prove a great aid.

"The Elements of Machine Design" is a very clear, concise, and well-illustrated textbook, and "Machine Design Problems" is a worthy companion volume, the two constituting a handy and useful combination for either student or engineer.

J. H. Parkin.

ANNOUNCEMENT OF MEETINGS

CALGARY BRANCH

Secretary-Treasurer, H. R. Carscallen, A.M.E.I.C.

Mar. 4th: Address on "The Development of the Art of Communication," by A. M. Mitchell.
Mar. 12th: Annual Meeting.

LETHBRIDGE BRANCH

Secretary-Treasurer, N. H. Bradley, A.M.E.I.C.

Mar. 5th: Address by Prof. R. S. L. Wilson, M.E.I.C. (Subject not yet available.)
Mar. 19th: Annual Meeting.

MONCTON BRANCH

Secretary-Treasurer, V. C. Blackett, A.M.E.I.C.

Mar. 29th: Address on "Gunnery," by John Stephens, M.E.I.C.

VANCOUVER BRANCH

Secretary-Treasurer, F. P. V. Cowley, A.M.E.I.C.

Mar. 2nd: Address on "Education and the Legal Profession." (Speaker not yet definitely arranged.)
Mar. 9th: Address on "Recent Advances in Metallurgy," by Prof. H. N. Thomas, B.Sc.
Mar. 16th: Open date.
Mar. 23rd: Address on "The Work of the Vancouver and District Joint Sewerage and Drainage Board, by J. M. Begg, A.M.E.I.C.
Mar. 30th: Open date.

SAULT STE. MARIE BRANCH

Secretary-Treasurer, A. H. Russell, A.M.E.I.C.

March: Address on "Engineer and Industry," by Col. C. H. L. Jones, of the Spanish River Pulp & Paper Mills, Ltd.

MONTREAL BRANCH

Secretary-Treasurer, C. K. McLeod, A.M.E.I.C.

Mar. 3rd: Address on "The Scientific Method in Industry," by G. P. Cole, M.E.I.C.
Mar. 10th: Address on "Development in Steam Boiler Design," by F. A. Combe, M.E.I.C.
Mar. 17th: Address on "Locomotive Feed Water Heating," by W. C. Hamm, Esq.
Mar. 24th: Address on "Geology of Island of Montreal," by A. Mailhot, Esq.
Mar. 31st: Address on "Tele Vision," by Dr. L. E. Pariseau.

HAMILTON BRANCH

Secretary-Treasurer, W. F. McLaren, M.E.I.C.

March: Address on "Concrete Roads," by A. M. Jackson, A.M.E.I.C., and address on "Sewage Disposal Plant in Kitchener," by Stanley Shupe, M.E.I.C.

EMPLOYMENT BUREAU

Situations Wanted

Civil Engineer

Available at thirty days' notice after April first. Member of Association of Professional Engineers of Nova Scotia, and licensed Nova Scotia Land Surveyor. Twenty years' experience in eastern, central and western Canada and the United States, including railway location and construction, water power development surveys, construction of dams, factory and office buildings, general steel plant construction, coal mine development, including construction of bankheads, yard tracks, underground surveys, and mechanical installations. Apply box No. 219-W, Engineering Journal.

Pulp and Paper Mill Engineer

A.M.E.I.C., educated London University, age 32, speaking both languages, with eight years' experience on design and construction pulp and paper mills, industrial plants, desires connection with pulp and paper company on maintenance, or with engineering and contracting firm. At present employed but available on few weeks' notice. Apply box No. 220-W, Engineering Journal.

Civil Engineer

Graduate B.Sc., Associate Member of the Institution of Civil Engineers, 34 years of age, desires to make new connection early in April. Eleven years' experience on a variety of civil engineering work, including municipal utilities, highways, canals, reservoir dams, hydraulic surveys, estimating, design and construction. Four years' war record, engineer officer in France. Apply box No. 221-W, Engineering Journal.

Sales Engineer

Mechanical engineer, A.M.E.I.C., desires to hear from manufacturers requiring a representative in Western Canada. Specialist in power plant equipment of all kinds; well acquainted with territory. At present engaged; available at thirty days' notice. Apply box No. 222-W, Engineering Journal.

Situations Vacant

Town Manager

Manager for pulp and paper mill town now in progress of construction. Must have engineering experience and be able to speak French and English fluently. Apply with full particulars to box No. 164-V, Engineering Journal.

Electrical Draughtsman

A firm of consulting engineers in Toronto, Ont., require the services of an electrical draughtsman experienced in hydro-electric power station design. In applying give full particulars and experience and state salary expected and when available. Apply box No. 165-V, Engineering Journal.

Engineers for Life Insurance Work

A life insurance company of the highest standing has vacancies for specialized work for which trained engineers have proved to have more than ordinary aptitude. The duties of the positions, which offer very good opportunities for advancement, demand men between the ages of 30 and 40, of good address, and possessing the ability to meet business executives. Apply box No. 166-V, Engineering Journal.

Seventy Years to Map Canada

"At the present rate of progress it will take seventy years to explore Canada's rich northland to the extent of showing its principal features on our maps," President Frank D. Henderson, D.L.S., told the annual convention of Dominion Land Surveyors at Ottawa recently, in an address in which he urged Dominion land surveyors, "who had made possible the orderly settlement of the fertile wheat lands of Western Canada, to use their utmost efforts to speed up the colonization of the almost totally unexplored and unexploited hinterland of Canada."

The American Cable Company, Inc., have issued a booklet entitled "Mining Section of the Wire Rope Users' Handbook," which contains a great deal of very useful information for users of wire rope. This information includes the selection, use and care of wire rope for mining services. The booklet has 103 pages and is well illustrated. Copies may be secured through the Canadian representatives, The Dominion Wire Rope Company, Limited, Montreal, Toronto or Winnipeg.

BRANCH NEWS

Halifax Branch

K. L. Dawson, A.M.E.I.C., Secretary-Treasurer.

A meeting of the Halifax Branch was held on the evening of Thursday, January 27th. According to the well established custom of the branch, this was a supper-meeting and was largely attended, a pleasing feature being the presence of several of the out-of-town members, who were cordially welcomed. After the supper a short business meeting was held and then the chairman, C. A. D. Fowler, M.E.I.C., introduced the speaker of the evening, A. J. Grant, M.E.I.C., chief engineer of the Welland ship canal.

Mr. Grant prefaced his address by expressing his pleasure in being in Halifax for the first time in over twenty years and noted some of the improvements that had been made during that time. In opening his address, which was profusely illustrated by lantern slides, Mr. Grant spoke of the first historic Welland canal, which was built by a private company and opened for traffic in 1829. It had 40 wooden locks, each 110 feet long, 22 feet wide, with 8 feet of water on the sills. In 1841 the canal was purchased by the Legislature of Upper Canada and since then has been under the jurisdiction of the Provincial or Dominion governments. From time to time the canal was deepened and widened, the locks increased in length and decreased in number. It became evident, however, that the traffic offering was far in excess of the capacity of the canal and during the past quarter of a century exhaustive surveys were made to determine the feasibility and cost of a waterway that would accommodate ships of at least 25-foot draft. As the result of these surveys the "Ten-Mile Creek" location was decided upon and work started in 1913. Owing to the European war, work on the canal practically ceased in 1916, and in 1918 the contracts let in 1913 were cancelled and the work entirely closed down. After the Armistice, work was resumed in a more or less intermittent manner on the cost plus percentage basis until in 1921 and 1922 these contracts were cancelled and the work relet under unit prices. The development has progressed steadily since that time, and it is expected that it will be completed in 1930.

The speaker explained some of the problems necessitated by the fact that the new canal crosses the present one in places and at times has the same location, it being necessary to maintain the existing canal so that traffic can be handled while proceeding with construction. He mentioned the construction railway, a double track line along the site of the canal on which there was enough traffic to require a twenty-four hour operating service and train movements enough to be the envy of many double track commercial roads. He made some comparisons with the Panama canal, showing in what respects the Welland canal was the greater of the two, and, in answer to questions, stated that ships would operate in and out of the locks under their own power, whereas in the Panama canal they were locked in and out by electric mules operated by the canal forces.

In concluding his speech, Mr. Grant ventured to prophesy that, on the completion of the Welland ship canal and the St. Lawrence canals, it would not only be possible but highly probable that the wheat laden boats from the Great Lakes would carry their cargoes to some maritime port, such as Sydney, there to tranship the cargo to ocean-going ships and then return carrying Nova Scotia coal.

A general discussion followed the address, Mr. Grant answering many questions put to him and at times elaborating on points already mentioned in his address. At the conclusion of the meeting a vote of thanks was moved and tendered by the chairman.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, Jr.E.I.C., Branch News Editor.

Regular Meeting, January 26th, 1927

A meeting of the Hamilton Branch of the Engineering Institute of Canada was held in the cafeteria of the Hamilton Technical Institute on Wednesday, January 26th, 1927, L. W. Gill, M.E.I.C., in the chair. There were fifty members and guests present. On the motion of C. J. Nicholson, A.M.E.I.C., seconded by J. J. MacKay, M.E.I.C., the following Nominating Committee was appointed:—

A. H. Munson, A.M.E.I.C.	A. R. Hannaford, A.M.E.I.C.
E. H. Darling, M.E.I.C.	Alex. Love, A.M.E.I.C.
W. B. Ford, A.M.E.I.C.	A. M. Jackson, A.M.E.I.C.

Mr. Gill introduced the guest of the evening, Lieut.-Col. H. J. Lamb, D.S.O., M.E.I.C., immediate past president of the Association of Professional Engineers of Ontario and supervising engineer of the Department of Public Works of the Dominion Government for Ontario. Col. Lamb has been actively engaged in the past twenty years on harbour and river works on the Great Lakes system of waterways and has had an opportunity of following the great development which has taken place during that period and has gained a thorough appreciation of the enormous asset that this waterway is to us, not only from a commercial point of view but also as a health and happiness factor in the welfare of so many communities situated along its shores and within easy reach of them. Col. Lamb's subject was "Engineering Problems and Traffic on the Great Lakes."

Engineering Problems and Traffic on the Great Lakes

The speaker pointed out that the Great Lakes waterway covered 95,160 square miles, a distance from Kingston at one end to Duluth at the other of 1,160 miles and 142 miles in the three connecting rivers. The drainage area of this is such that the supply practically balances the discharge through the St. Lawrence river, resulting in an unusual steady flow averaging 220,000 cubic feet per second. No other river of its size can compare with it in steadiness of flow.

The various engineering problems which were encountered in providing through navigation from one end of the lakes to the other were described in a very clear and interesting manner. The work involved has briefly been as follows:—

(1) Establishment of international boundary line.
(2) Charting the system and establishing aids to navigation.
(3) Construction of harbours.
(4) Construction of canals and locks.
(5) Improvement of the river channels.

Slides were shown illustrating the Great Lakes' system, the present international boundary, the types of breakwater and harbour construction used in the Great Lakes, the various canals, and types of steamers in use for Great Lakes traffic.

The Welland Ship Canal is the second largest work of its kind in the world and is estimated to cost about $115,000,000.

The first canal between lake Ontario and lake Erie was built by a private company in 1829 and has been followed by other canals, each being an improvement on the preceding one. The contrast between the original privately owned canal with forty locks and the new Welland ship canal with only seven locks is an outstanding example of engineering achievement.

The system of canals at Sault Ste. Marie is another outstanding feature. In 1923 the tonnage through the various canals on both sides of the river exceeded the combined tonnage through the Suez, Panama and the Manchester ship canals. The first canal was built by the North-West Fur Company in 1797-98 and was partly destroyed by United States troops in 1814.

The twin ports of Port Arthur and Fort William are equipped with twenty-five grain elevators, having a storage capacity of sixty-five million bushels. Ships can be loaded at the rate of eight million bushels per day. The largest boat in the Great Lakes service is the Canada Steamship Company's "Le Moigne," which has a capacity of 520,000 bushels and is 633 feet long.

After considerable discussion and questions from members, a hearty vote of thanks was tendered the speaker on the motion of W. L. McFaul, M.E.I.C., seconded by H. A. Lumsden, M.E.I.C.

After light refreshments and song singing there was some discussion regarding the Association of Professional Engineers. A strong appeal for support of the Professional Association was made by Col. Lamb, Mr. McFaul and Mr. Jackson. Col. Lamb spoke particularly of the close co-operation between The Engineering Institute of Canada and the various professional organizations, pointing out that there is no conflict between them since the function of The Engineering Institute of Canada is educative, whereas the Professional Associations are legislative.

Executive Meeting

A meeting of the Executive Committee of the Hamilton Branch was held in the office of W. L. McFaul, M.E.I.C., on February 7th, with six members of the Executive present.

A letter from the secretary of the Hamilton Chamber of Commerce announcing the approval by their board of directors of a permanent standing committee to which engineering and public utility questions could be referred and enclosing a list of Institute members in the Chamber of Commerce as a suggested nucleus for the committee was read. On the motion of H. A. Lumsden, M.E.I.C., seconded by H. B. Stuart, A.M.E.I.C., this committee was endorsed with the addition of the secretary and the chairman of the Hamilton Branch.

The personnel of this committee for the present year is as follows:—

W. D. Black, A.M.E.I.C.	H. A. Lumsden, M.E.I.C.
E. H. Darling, M.E.I.C.	W. G. Milne, A.M.E.I.C.
L. W. Gill, M.E.I.C.	J. J. MacKay, M.E.I.C.
H. U. Hart, M.E.I.C.	R. K. Palmer, M.E.I.C.
F. I. Ker, A.M.E.I.C.	F. W. Paulin, M.E.I.C.
R. L. Latham, M.E.I.C.	W. F. McLaren, M.E.I.C.

This year the branch chairman is also a member of the Chamber of Commerce.

Some discussion ensued regarding the annual general meeting in Quebec, and it was decided to pay a portion of the branch chairman's expenses as an official representative of the branch at the meeting.

Certain applications for admission or transfer were considered and referred to the Membership Committee. Details regarding the branch meeting on February 16th were discussed.

Regular Meeting

A very interesting meeting of the Hamilton Branch was held on Wednesday evening, February 16th, in the cafeteria of the Hamilton Technical Institute. Since the branch chairman, L. W. Gill, M.E.I.C., was in Quebec attending the Annual General Meeting of The Institute, W. L. McFaul, M.E.I.C., the vice-chairman of the branch, occupied the chair. After the minutes of the previous meeting had been read, Mr. McFaul announced that A. R. Decarey, M.E.I.C., had been elected president of The Institute and W. F. McLaren, M.E.I.C., had been elected councillor for the Hamilton Branch for the third time.

It was announced that a joint committee had been appointed consisting of members of the Chamber of Commerce who are also members of the Engineering Institute of Canada, together with the branch secretary and branch chairman.

On behalf of H. A. Lumsden, M.E.I.C., chairman of the Papers Committee, who was attending the Highway Engineers' convention in Atlantic City, it was announced that the next meeting of the branch would be held about March 16th. The speakers will be A. M. Jackson, A.M.E.I.C., of Brantford, who will speak on "Concrete Roads," and Stanley Shupe, M.E.I.C., of Kitchener, who will speak on the "Sewage Disposal Plant in Kitchener."

A little discussion followed regarding the prizes which the Executive Committee offered to members and students of the branch, and students of the Hamilton Technical Institute, and the action of the Executive Committee was confirmed. A motion was passed authorizing the branch Nominating Committee to nominate the Prize Committee, to be elected at the annual branch elections and to be representative of all branches of engineering so far as possible.

Electric Control of Movable Bridges

The programme for the evening consisted of short talks by various local engineers. Mr. J. P. Fraser, of the Canadian Westinghouse Company, gave an interesting talk on the electric control of movable bridges. He showed several slides illustrating different types of movable bridges and the complicated control apparatus. The types of bridges are: the swing bridge, the bascule bridge, of which the highway bridge across the canal is an excellent example, and the lift bridge, in which the movable portion is lifted straight up, remaining horizontal.

Mr. Fraser described the various interlocks and the safety devices which result in the operator merely having four simple operations to perform, namely, setting the traffic signals, closing the traffic gates, releasing the locks and opening the span.

In the discussion that ensued, E. H. Darling, M.E.I.C., remarked that a short time ago the control was very simple, consisting merely of one double throw switch which was thrown in one direction to open the bridge and in the other direction to close the bridge. He mentioned the contrast between the old simple control, which required a lot of skill on the part of the operator, and the present day complicated control, which makes the operator's job the sort of position Mr. Darling would like when it comes time for him to be superannuated.

Street Illumination

Mr. G. F. Mudgett, also of the Canadian Westinghouse Company, spoke on "Street Illumination." He pointed out that adequate illumination prevents crime and enhances property values, as well as beautifying the city and reducing the number of traffic accidents.

He traced the development of street illumination from the tall towers of twenty years ago that illuminated the roofs of houses beautifully but left the streets somewhat dim, through the intermediate stages, to the present day highly specialized units that distribute the light wherever it is desired. By the proper design of the light controlling device and the enclosing globes it is possible to distribute the light so that practically all of it is thrown on to the roadway.

Considerable discussion ensued, particularly regarding the street lighting problem in Hamilton. Mr. Andrew Bratt, of the Hamilton Hydro-Electric System, mentioned the layout of street lighting in Hamilton; single 750-watt lamps are in use in the central business district with 500-watt lamps in the secondary business area. In the residential district 100-watt lamps, spaced 100 feet apart, are used, with 200-watt lamps on the corners, and on street car streets lamps are placed on both sides. Since the largest unit in use for street lighting service is two 750-watt lamps on one standard, Hamilton has not yet reached the last word in street lighting. In fact, street lighting in Hamilton is far from good.

In the discussion it was pointed out that it was possible to improve the intensity of the light on the street surface by the use of new glass which would give a better distribution of light. This would be at the same annual cost of lighting, but there would, of course, be the installation charges. It was also recommended that glass canopies be used to replace the present metal reflectors.

Manufacture of Pig Iron

Mr. H. G. Girvin, of the Steel Company of Canada, spoke briefly on the "Manufacture of Pig Iron." He discussed the blast furnaces, including the hearth, tuyers, bosh, and the brick work, and he mentioned the precautions that had to be taken to eliminate or control the metalloids on account of the variation in properties of the finished material.

Traffic Signals

A. R. Hannaford, A.M.E.I.C., spoke on traffic signals as distinguished from mere signs indicating traffic direction. The first traffic signal was the "Indian Smoke Signal," which came to the attention of Europeans around 1517. He rapidly sketched the development of traffic signals and described the types of flashing signals in use in other cities, including the central suspended type, which is used in Hamilton, the central standard type, and the side bracket type. He pointed out that no one type of signal can be used entirely by any city, as different conditions demand different types. At Cannon street and Sherman avenue, in Hamilton, it was found necessary to use a bracket signal as well as a central suspended signal.

Mr. Hannaford described the timing devices for the signals used in Hamilton, which consist of a clock work machine operated by a 1/20-h. p. electric motor for the signals at James and Cannon streets and at the Delta, and of a magnetic control arrangement for the signals at Main and James, at Main and John and at King and Sherman. Each intersection in Hamilton is regulated by a separate control box, which was the most economical method to adopt, since the underground cable connecting two signals would have had a considerably higher cost. When the number of lights is increased these control boxes may be used to handle four to six intersections, according to conditions.

In Hamilton the timing is so arranged that there are thirty-five seconds of traffic on the main street, with twenty-five seconds on the cross streets. There is a five-second period during which the yellow light shows in a three-colour signal or the signal shows red in all directions in the two-colour signal. In the case of the Main and James and the Main and John signals, the timing is so arranged that an automobile going west on Main street at twenty miles per hour will find that the James street signal turns to green just as he reaches it, if he was held up at Main and John.

A lot of discussion ensued regarding the relative merits of the two-colour signals and the three-colour signals, also regarding the stop-street by-law which is in force in Hamilton and requires vehicles approaching certain through streets to come to a full stop before entering on the street, and the lighting of the signs marking the stop streets. It was pointed out that several of these signs are so much in the shadow that it is impossible to see them at night.

On the motion of J. J. MacKay, M.E.I.C., a hearty vote of thanks was tendered to the speakers. At the conclusion of the meeting sandwiches and coffee were served. The Mouthorgan orchestra of the Technical School rendered several selections during the serving of the refreshments. This was a very pleasant innovation. Considering everything, the fifty members present felt that this was one of the most successful meetings of the branch.

Lethbridge Branch

N. H. Bradley, A.M.E.I.C., Secretary-Treasurer.
C. J. Broderick, Branch Affiliate, Branch News Editor.

Concrete

Concrete is not a subject conducive to the usual small talk of the average dinner or social gathering, but on Saturday night, January 8th, 1927, when K. MacKenzie, Jr.E.I.C., service engineer of the Canada Cement Company, chose it as the subject of his address to the Lethbridge Branch at the regular bi-monthly dinner of the engineers, a discussion was started that lasted until eleven o'clock.

Master of his subject in all its varied details, Mr. Mackenzie stood for an hour, after completing his prepared paper, a target for questions fired at him from all quarters of the hall. As one of the engineers put it, "If Mr. Mackenzie had been talking politics in the same vein, he would have been branded a red revolutionist." Radical though his theories were, he carried conviction. Perhaps it is not quite fair to claim his arguments theoretical, for they have all been put to the test and proved sound, notably so in the construction of the mammoth new Hudson's Bay building at Winnipeg and in the Cement Company's own building at Montreal.

Briefly stated, his principle was that four gallons of water to one sack of cement would give the same strength of concrete regardless of what quantities of other materials are used, so long as the mixture is plastic and workable.

Questioned just before his address, he stated that while the year 1926 showed a cement consumption in western Canada of only 15 per cent increase over 1925, the coming year promises better than any year since before the war. "You will see a wonderful increase in municipal work this year," he said, "paving programmes are well advanced in the towns and cities of the west, and structural work will be heavy." All in all, he was very optimistic that the west has struck its stride and prosperous conditions were in sight. "I don't want to appear over optimistic," he declared, "we don't want any more booms through over-confidence."

The average man on the street listening to a discussion such as that on Saturday night would leave with a new respect for such prosaic things as a concrete sidewalk, or the pavement over which he drives his car. All over the continent men are studying this question of concrete. Every university has research engineers testing and experimenting. All to the end that the public may be safeguarded against faulty materials entering into their bridges, their buildings or their roads.

How important this research is may be understood from such statements as this of Mr. Mackenzie's: "Less than two and one-half gallons of water," he said, "are sufficient to hydrate one sack of cement, and while it is necessary to use more than this amount of water to produce a workable mix of concrete, any water in excess of that required to hydrate the cement reduces the strength and makes a more porous concrete. Excess water also tends to cause shrinkage cracks which may later develop and cause the concrete to fail."

This principle is evident when cement is likened to glue. The more a glue is diluted with water, the less is the strength obtained. It follows then that a concrete required to meet a certain definite strength must take into account the volume of water to be used per sack of cement. The other elements entering into concrete, the stone and the sand, only affect the strength as they affect the quantity of water required to produce a workable mixture. In this respect the volume of water used is affected also by the moisture in the sand. A cubic foot of sand ordinarily holds from a quarter to three-quarters of a gallon of moisture.

All this, of course, is directly of interest to the engineer and the contractor. The public sees merely the completed structure. It is only when a structure fails that the public realizes the importance of such principles, and gets some faint idea of what is going on behind the scenes among our scientists and engineers.

Mr. Mackenzie gave a graphic account of the cementing of an oil well. There is always a small opening between the casing and the drill hole and unless this opening is filled with a gas-tight material trouble occurs from water flowing into the well or gas escaping. Pure cement is used. The casing is raised a few feet and a high pressure pump forces water down. This water then rises between the casing and the drill hole to the surface forcing mud, oil, etc., ahead of it until the water that rises comes clear. A cement mixture is prepared containing calcium chloride. A wooden plug is inserted in the casing. The cement mixture is pumped in on top of the plug. Then a second plug is put in and water is pumped in, forcing the two plugs with the cement mixture between them down the well until the lower plug drops out, allowing the cement to be forced around the end of the casing and up between the casing and the drill hole. This pumping continues until the top plug rests on the lower plug and the casing itself is full of water, which produces sufficient pressure to keep everything in position until the cement hardens. Then the wooden plugs are drilled out and boring goes on as usual.

Technical though this lecture of Mr. Mackenzie's was, the thought predominated throughout that were it not for the hundreds of silent thinkers in our universities and laboratories of industrial concerns, this world would be a queer place.

The dinner was enlivened by the Rainbow Orchestra, community singing and songs by Mr. Smith. G. N. Houston, M.E.I.C., presided in the absence of the chairman, J. T. Watson, A.M.E.I.C., whose duties at the power house kept him away.

Water Powers of Canada

Doubters, if there be any, of Canada's position in world affairs must have had their fears dispelled after listening to an address such as that presented before the Lethbridge Branch on Saturday night, January 22, 1927, by A. L. Ford, M.E.I.C., engineer of the Dominion Water Powers Branch, who discussed in detail the water powers of Canada. It was the type of speech that must thrill Canadians with the immensity of our power resources—the greatest single agency behind modern industrial progress.

Available records show that Canada's power resources permit of a turbine installation of almost forty-two million horse power. But what is perhaps the most surprising statement is that in developed horse power Canada stands second only to the United States, having developed 4,290,000, and further, that Canada is second for developed horse power per unit of population, Norway coming first and the United States fifth. Among the provinces, Quebec comes first with 11,640,000 horse power and an installation of 1,915,000 horse power; Ontario is second and Manitoba third, British Columbia fourth and Alberta fifth with 1,137,000 horse power and an installation of 34,000 horse power. These figures do not consider storage possibilities.

Of the water powers in the Lethbridge and Crow's Nest area, Mr. Ford stated they were very limited and depended largely on the question of storage, and to a large extent the entire power problem of Alberta is one of storage.

"In Alberta," said Mr. Ford, "our streams are subject to seasonal fluctuation, high in summer and low in winter. The consumer demand is exactly the opposite, being low in summer and high in winter, due to the lack of steady loads such as for pulp and paper industry and manufacturers. If Alberta is to make the best use of its power streams, we must contemplate either storage reservoirs or steam stand-by plants."

Up to this point Mr. Ford had been discussing his subject with charts and graphs. Statistics are difficult to follow when presented in cold figures, but as the pointer followed these charts with their peaks and valleys, his figures were made to tell a wonderful story of progress and opportunity for Canada. This Dominion has come along in giant strides industrially since the beginning of the present century when the water power developed was a mere 150,000 horse power. By 1910 it was 965,000 horse power. Then witnessed a leap forward—in 1920 it was 2,500,000 horse power, while today there is a development amounting to 4,556,000 horse power. Only 11 per cent of the available resources have yet been touched. Looked at from statistics alone, it would appear that Canada's water power is unevenly distributed through the provinces, but industrially this is not so, for what power is available has been by a kind nature placed strategically to serve centres of industry.

By means of a most comprehensive series of aerial photographs thrown on the screen, it was easy to follow the growth of power plants across the Dominion, but it was when the speaker got down into Ontario and Quebec that the immensity of power development was apparent. In these two provinces, where pulp and paper mills are springing up like mushrooms, where provincial governments are working out gigantic schemes of electrical development, every possible source of supply is being canvassed. To those who would say that Canada is not advancing industrially, that we are falling back before the factories of our neighbour to the south, it is only necessary to produce the facts and figures so graphically presented by Mr. Ford. If the slides alone could be thrown on the screen of the movie houses across the Dominion, the people of Canada would realize something of the potential greatness of their country.

Canadians have come to believe that theirs is pre-eminently an agricultural country. In this respect it was surprising to hear from Mr. Ford that the value of manufactured products in Canada now exceeds the value of agriculture. Attracted by our resource of power foreign capital is coming into the country rapidly, making for an ever increasing export trade of manufactured goods. Low grade ores are found to be practical where once they were scorned. With inexpensive power there need be little fear for Canada's prosperity.

An important feature of this hydro-electric development applied to the marketing of coal. The big consumption of coal has in the past been in Ontario and Quebec. In proportion as these two provinces advance in their water powers, the importation of coal will decline and what is now proving to be something of a national problem may solve itself.

Mr. Ford touched upon the stability of invested capital in water power projects. He said that the amount of money now invested in this resource far exceeds that in any other industry, and investigation has shown that only one company involved during the last twelve years has failed.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

A combined meeting of the Moncton Branch and the Engineering Society of Mount Allison University was held at Sackville on January 13th. A. S. Gunn, A.M.E.I.C., occupied the chair. A very interesting paper was read by A. F. Dyer, M.E.I.C., chief engineer of the Nova Scotia Construction Company, Halifax, N.S., on the subject of the "Lake Kenogami Storage Dams." The address was illustrated by lantern slides.

Lake Kenogami Storage Dams

Lake Kenogami lies to the south of lake St. John and discharges into the Saguenay river by means of two outlets, the Chicoutimi and Ausable rivers. Increased demands for power led to the building of dams across the rivers with a consequent rise of twenty-three feet in the water level of the lake. The largest of these structures is the dam across the Chicoutimi river. It is 1,500 feet long, has a maximum height of 80 feet and is built entirely of concrete. A roadway 17 feet 6 inches wide extends along the top. A large part of the work was done during the winter months with temperatures ranging almost continuously from 10 to 20 degrees below zero. Notwithstanding the severe weather conditions, no damage whatever was experienced from frost. The concrete ingredients were heated with steam jets previous to mixing. The surface on to which the concrete was to be poured was warmed for at least twelve hours before the placing of concrete. This was done by covering over with tarpaulins, under which stoves were placed. Hot water was found far more efficient than steam for cleaning off snow and ice. In answer to a question, Mr. Dyer declared that he did not consider harmful the freezing of the top layer of concrete in a partly completed structure. When pouring was resumed the heat generated by the chemical action of the new concrete would quickly thaw out the frozen layer and cause it to again take on the properties it had when freshly mixed, resulting in a perfect bond between the new and old.

At the conclusion of the address a vote of thanks was tendered Mr. Dyer, moved by Prof. F. L. West, A.M.E.I.C., and seconded by E. Bannerman.

The Welland Ship Canal

Tracing the history of the Welland Ship canal from its beginning until the present time, Alexander J. Grant, M.E.I.C., engineer-in-charge of the project, gave an exhaustive résumé of the gigantic work before the members of the branch at a supper-meeting held in the Y.M.C.A. on January 26th. The address was profusely illustrated with lantern slides. A. S. Gunn, A.M.E.I.C., chairman of the branch, presided.

The canal under construction will be the fourth built across the Welland peninsula. The estimated cost is $115,000,000 and it is expected the work will be completed about 1930. The canal is 25 miles long and about 300 feet wide. The 325-foot difference in elevation between lakes Ontario and Erie is taken care of by seven locks, each having a lift of 46 feet 6 inches. It is interesting to make comparisons with the Panama canal, which has a total lift of 86 feet, the maximum single lift being 30 feet 4 inches.

The canal begins at port Weller on the lake Ontario side and goes through to port Colborne on the lake Erie side. It will allow vessels of 25-foot draught to pass through. At port Weller a harbour has been built which consists of two breakwaters extending into the lake a distance of one and a half miles, each being 800 feet wide at the shore end and tapering to 400 feet at the outer end. At port Colborne two converging breakwaters are also built, one mile from shore, protecting two piers placed inside, near which a 1,000,000-bushel elevator is erected.

No tolls are charged, the canal being free to both Canadian and American shipping. In this connection it is worthy of note that no attempt has ever been made to connect the two lakes by a canal built on American territory.

A hearty vote of thanks, moved by F. B. Fripp, A.M.E.I.C., and seconded by C. S. G. Rogers, A.M.E.I.C., was tendered the speaker by the chairman.

Previous to the address the members were entertained by enjoyable soprano solos by Mrs. R. L. Steeves and bassoon selections by Mr. Percy Belyea.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

Power Films, Shawinigan Water & Power Company

It would seem from the number of members present on Thursday evening, January 20th, that "movies" were much appreciated as a welcome change to the usual weekly papers. Through the courtesy of the Shawinigan Water and Power Company, a four-reel film was exhibited, showing the development of electrical power from the early stages to the present time.

An introductory description of the pictures was given by C. K. McLeod, A.M.E.I.C., after explaining the unavoidable absence of an officer of the Shawinigan Water and Power Company, who was to have given this description.

A comparison was made between the building of the Egyptian pyramids, as an early example of large construction work, with the difficulties of transportation and handling of material in those days, and the present day methods, with the use of electric power; the difference in speed and cost of transportation by old and new methods being illustrated. Included in the pictures were illustrations of the use of man's power, ox power, horse power, wind power, steam power and finally electric power.

Interesting views were shown of the Shawinigan Water and Power Company's dams and power plants at St. Maurice, Grand'-Mere and LaGabelle, as well as Montmorency falls, Chaudiere and others, and of industries which have arisen in areas well supplied by electrical power. Views of the largest transmission crossing in the world, over the St. Lawrence river at Three Rivers, Que., were shown, and also of streets in Montreal and Quebec lighted by electric power.

The Montreal Branch is much indebted to the company for the use of these films, which were much appreciated.

Railway Lands—Titles, Surveys, Leases and Taxes

On January 27th a paper was read on this subject by Frank Taylor, M.E.I.C., who is in charge of the department of the Canadian Pacific Railway which handles this work.

In view of the fact that the organization and functions of the land department are not quite similar on any two railways, the author dealt with this work as it is conducted by the right-of-way and tax agent of the Canadian Pacific Railway, whose functions include all matters in connection with the right-of-way, titles, surveys, leases and taxes of railway lands, other than agricultural lands in the western provinces, which are dealt with by the department of colonization and development.

The laws in the different provinces governing squatters' rights were cited and it was shown that without accurate records of property owned by the railway, how easy land may be lost by the exercise of these rights.

A description of the title record plans as used on the Canadian Pacific Railway was given. For ordinary right-of-way, these plans are made up, each covering ten miles of railway, and are plotted from the description contained in the title deed of each individual lot and each lot outlined in a different colour; changes are made on these title record plans as may be necessary from time to time when any of the land is sold or any adjacent land purchased. The preparation of these graphic records is much complicated in the case of large cities, and also in the case of small railways acquired at various times, and where title deeds may be missing for certain portions of the right-of-way. The author mentioned that during the past twenty years re-surveys and plans had been made of some 4,000 miles of railway on certain lines of the Canadian Pacific Railway. As these lines are mostly composed of many small railways constructed years ago, it was rarely the case that "as constructed" plans were available.

The various forms of occupancy of railway lands covered by lease were cited by the writer and the basis for assessing rentals on such property. He also dealt fully with the question of taxes, which is a large item of expense to a railway company, as not only are taxes paid to municipalities but to the provincial and federal governments.

Reference was made to land which was exempt or partially exempt from taxation, the forms applying mostly to the main line through Saskatchewan and Alberta, which was given perpetual exemption under the original charter.

A considerable amount of discussion followed the reading of the paper. The chairman of the evening was D. Hillman, M.E.I.C.

Traffic Regulations by Automatic Signals

On February 3rd Mr. K. W. Mackall, of the signal engineering department of the Crouse-Hinds Company, Syracuse, N.Y., gave a lecture on the use of automatic signals for the "Regulation of Street Traffic," which was illustrated by lantern slides. The speaker described the various types of traffic control signals that have been tried or installed in different cities, commencing with the traffic tower on Fifth avenue, New York, which was equipped with powerful search lights, down to the most modern electrically controlled systems. Diagrammatic pictures of street intersections were shown, illustrating the various positions in which controlled signal lights can be placed, and the advantages or disadvantages of each position were explained.

The lecturer stated that the first modern interlocking signal system was installed at Hewston, U.S.A., about five years ago. Various systems of coloured lights are in use, but the most common are "green" for "go," and "red" for "stop," and "amber" to clear traffic in one direction before traffic can start in the other, or for "caution." The three systems of control in use are known as the "synchronous control," the "progressive system of control," and the "co-ordinated system." Ninety per cent of the installations at present in use are of the synchronous control type.

The speaker referred to the haphazard way in which many cities are installing traffic control, and stated that it was very necessary that the matter should be given careful study, as a system which suited one city might not be at all suitable for another. He recommended that the traffic problems should be placed in the hands of a competent engineer, who should have the co-operation of all departments in any way associated with traffic matters.

In regard to street car traffic, Mr. Mackall stated that reports varied considerably as to the retarding or increasing the rate of this traffic.

C. J. Desbaillets, M.E.I.C., proposed a vote of thanks to the speaker. The chairman was J. F. Brett, A.M.E.I.C.

Radium

A most interesting lecture on the subject of "Radium" was delivered by Dr. J. E. Gendreau to the members of the Montreal Branch on the evening of February 10th in the Convocation Hall of the University of Montreal. Dr. Gendreau is the director of the Radium Institute, Montreal, and is well known as one of the outstanding authorities in Canada on the study and use of radium. The speaker dealt with the physical, chemical and biological properties of radium, giving a history of its accidental discovery and an outline of the work done by Monsieur and Madame Curie in a small laboratory in Paris in the development of this discovery. He explained and demonstrated the radio-activity of uranium, by which radium was first discovered, and also found to be in combination with pitch-blende, a dark pitch-like mineral from which uranium is extracted.

Dr. Gendreau gave a demonstration of fluorescence, the property of certain bodies, such as fluorspar, of producing or emitting light other than reflected or transmitted light. He also explained that the rays from radium, known as Bicquorel rays, named after Dr. Bicquerel, the discoverer of radio-activity, are not the same as Rontgen rays or X-rays.

A considerable amount of apparatus was used in interesting experiments to practically demonstrate the various points in the lecture and a half gramme of radium was exhibited, valued at $40,000.

Reference was made to the great work at present being carried on in connection with radium research by Dr. Rutherford, formerly of McGill, and pictures of the various persons mentioned were shown on the screen.

A vote of thanks to the lecturer was proposed by F. B. Brown, M.E.I.C., who spoke very highly of the work and accomplishments of Dr. Gendreau. The chairman of the evening was Mr. O. O. Lefebvre.

Niagara Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

At Welland on January 25th the branch held a very well attended dinner meeting.

Dredges and Dredging

W. E. Bonn, A.M.E.I.C., engineer-in-charge of dredging, Toronto Harbour Commission, was the speaker. His subject was, naturally, "Dredges and Dredging," and proved quite timely in view of the enormous quantities of material that are being handled on the canal work in the district.

E. G. Cameron, A.M.E.I.C., introduced the speaker as an old friend and co-worker of his in St. John, N.B., and intimated that dredging engineers have a technical vocabulary all their own and that even in the worst coast fogs he could tell when Mr. Bonn was in the vicinity by the strange sounding words and resonant tones that were used. Years of practice, endeavouring to drown out the din made by the average ladder dredge, was necessary to achieve such results.

Mr. Bonn then showed some excellent aerial views of the Toronto harbour development, where hydraulic or suction dredges are used almost exclusively, and explained the methods of conveying the material and dykeing for reclaiming land areas.

In order that navigation should not be interfered with a plan was developed whereby the pontoon or trestle carriers were partly eliminated and the conveyor pipe from the dredge to the shore line was sunk and laid along the harbour bottom. This proved to be less expensive than trestle work even in the first instance, six hundred feet a day being put into place as compared with about two hundred feet possible with trestles.

After this review of the Toronto work, Mr. Bonn went on to show other slides of various types of dredges and discuss their merits. The hydraulic dredge was conceded to be the most economical type for the finer classes of material from mud and silt to coarse sand. When gravel in any quantity was encountered, however, the dipper and ladder dredges came into their own, and for boulders the ladder dredge took the lead in efficiency.

The latest word in hydraulic dredges was the "Clakamas" at Portland, Oregon, with 3,400 horse power Diesel engines and motor-driven pumps. Her record was 754,000 transport units and 955 cubic yards per pumping hour as compared with the "Tualatin's" 450,000 transport units and 571 cubic yards. A "transport unit" being equal to 1,000 cubic yards pumped through 100 feet of line pipe with a lift of one foot.

J. R. Bond, A.M.E.I.C., moved a vote of thanks and referred in a humorous way to some of his experiences while Mr. Bonn was supervising the dredging near Chippawa. Owing to the similarity in their names, Mr. Bonn got all the credit, while if anything went wrong or if the dredge broke a gas main, Mr. Bond received all the blame from the local residents.

E. P. Johnson, M.E.I.C., seconded this vote of thanks and Chairman Alex. Milne, A.M.E.I.C., took occasion to say that the true spirit of thrift is economical progression, and that was dependent upon the dissemination of just such information about efficient machinery and methods as the speaker had conveyed to the meeting.

New Members of the Branch

Messrs. A. T. C. McMaster, M.E.I.C., and A. L. Mudge, M.E.I.C., have lately joined the staff of the Welland Ship canal as hydraulic engineer and electrical engineer respectively.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

The Annual Ball

Under the distinguished patronage of their Excellencies the Governor-General and the Viscountess Willingdon the Ottawa Branch of the Engineering Institute entertained at their annual ball in the Chateau Laurier on January 27th. No event of the season is more eagerly anticipated in Ottawa than this yearly dance, and it proved quite as delightful and successful as on former occasions.

Palms adorned the foyer of the Chateau, where the hostesses of the evening received their guests, just at the entrance. Mrs. Noulan Cauchon, wife of the chairman of the Ottawa Branch; Mrs. F. H. Peters and Mrs. Gordon Gale graciously welcomed everyone.

The ballroom was thronged with gay dancers. Here the emblem of The Institute, a large shield depicting the Canadian beaver, was placed between the two main windows. An excellent orchestra provided a lilting programme of dance numbers. The Tudor room was used for sitting out and for the serving of fruit punch.

Supper was served in the main dining room at 11.30 o'clock, the long buffet tables, which were placed at the sides of the room, being adorned with tall vases of cut spring blooms.

The committee in charge of the arrangements, which were most capably carried out, was composed of Mr. Russell K. Odell, convener, H. M. Barton, A.M.E.I.C., and J. D. Craig, M.E.I.C. Others who assisted the committee in looking after the guests were N. Cauchon, A.M.E.I.C., J. L. Rannie, M.E.I.C., Commander C. P. Edwards, A.M.E.I.C., K. N. Cameron, M.E.I.C., and J. B. McRae, M.E.I.C.

Noulan Cauchon, A.M.E.I.C., newly elected chairman of the Ottawa Branch, presided at a luncheon at the Chateau Laurier on February 10th, at which Engineer Commander T. C. Phillips, R.C.N., M.E.I.C., spoke on the subject of "Engineering Development in Fighting Ships."

In introducing the speaker, Mr. Cauchon extended a hearty welcome to Grote Stirling, M.P., whom he characterized as the only engineer in the House of Commons, and provoked considerable laughter in his remarks concerning some early engineers. He alluded to two early ornaments of the profession, Yu, Chinese emperor of ancient times, who owed his exalted post to his proficiency as an engineer, and to Julius Caesar.

Engineering Development in Fighting Ships

Commander Phillips traced the evolution of fighting ships, commencing with the galleon which held sway for 3,000 years and had some advantages over its successor, the sailing ship, in that it had a definite speed and could be manoeuvred for fighting. It was manned by hundreds of slaves—an unfailing motive power—in contrast to the sailing ship which was often becalmed within sight of the enemy. Then steam propulsion came and the earliest fighting ship of the Royal Navy, the "monkey," in 1821 was looked at askance, and little wonder, with its square boilers and 4 to 8 pounds pressure, and its paddle wheels which could be easily put out of commission with a well-directed shot. The screw propeller helped to break down the objections of the naval men. The replacement of wooden hulls with steel and development of the special ductile steel required for armour plate completed the transformation and we had the modern battle ship.

But was that all? said Commander Phillips, and he proceeded to speak of the great service which engineers had performed in providing a ship which could stand punishment as well as give it. A warship, like a pugilist, had to be able to give and take. The merchantship was entirely different from the warship in that it could not take punishment. The hull of the merchantman contained few watertight compartments and the puncturing of one or two rendered the ship unseaworthy. The battleship, with its many bulkheads, could have compartment after compartment pierced and not only remained seaworthy but could keep on fighting.

The internal arrangements of the fighting ship were most complex and a wonderful tribute to engineering efficiency in providing for disaster. Four separate sets of engines with separate propellers were provided to drive a battle cruiser of 45,000 tons. The "Hood," one of the most powerful, had engines of 150,000 horse power, which were capable of driving the ship at 38 miles per hour, or as fast as one of the express trains between Ottawa and Montreal.

Commander Phillips graphically described the mechanism of the up-to-date warship and its quadruple mechanisms to provide for every contingency. Light must be guaranteed for the bowels of the ship, and four lighting sets were installed; when one went out of action another was instantly started. Other duplication included four steering sets, four hydraulic sets and twelve refrigerating sets. Summing up, the speaker contrasted the "Hood" with the "Victory," Nelson's flagship. The range of the 18 hand-operated guns of the "Victory," to which 32-pound balls were fed by "powder monkeys," was 1,200 yards. The "Hood" has eight 15-inch guns firing a projectile weighing a ton and with a range of 30,000 yards. The whole main battery could fire fifty tons of projectiles in one minute. To keep this wonderful mechanism in operation required a crew of 1,500 officers and men. A comparison was also made between the old Mediterranean fleet and the present day fighting ships stationed there. These have, he said, a combined power capacity of two million horse power.

Surveying in the Mountains

On February 17th, at the Chateau Laurier, under the auspices of the Ottawa Branch, M. P. Bridgland gave an address on "Surveying in the Mountains." Mr. Bridgland, who has been mapping in the Canadian Rockies and Selkirks continuously for twenty-five years, is a recognized authority on photo-topographic methods of survey and his address, beautifully illustrated with Canadian mountain views, was listened to by a large and attentive audience.

Introduced by Chairman Noulan Cauchon, A.M.E.I.C., Mr. Bridgland outlined the methods of surveying and mapping the extremely rough country pertaining in a vast area of Alberta and British Columbia, where mountain peaks range from 8,000 to 11,000 feet above sea level, and where snow fields and glaciers of large size are very numerous. The difficulties of producing maps of this area, showing accurately the topographical features of the ground, were overcome by photographic methods of survey, introduced into Canada by the late Dr. Deville, surveyor general.

The principle upon which the photographic method depends is that if two views of the same terrain are taken from different camera stations, points common to both photographs can be plotted and their elevations determined. Views covering the entire country to be mapped are therefore taken from various mountain peaks in such a way that each part of the ground appears in at least two photographs from different viewpoints. The photographs are taken horizontally, the plate being held truly vertical in the specially constructed survey camera. These views are perspectives and the problem of plotting and subsequent contouring of the map is that of inverse perspective or reconstruction in plan.

Mr. Bridgland explained the system of control by which the positions of the camera stations are determined. This is a matter of triangulation and the climbing party carries both transit and surveying camera. Both these instruments are interchangeable on the same tripod and the camera is levelled up carefully the same as a transit. In concluding his address Mr. Bridgland explained the use of the various instruments.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

The Manufacture of Carbon Products

At a regular meeting of the branch on Thursday, January 13th, 1927, a paper with the above title was presented by the late Mr. J. C. Webster, engineer with the Canadian National Carbon Company, Ltd.

This interesting address was illustrated by a fine three-reel moving picture depicting the processes described by the speaker. Complete details of the paper are not given here, as it had previously been delivered before the Hamilton Branch and reported in the January, 1927, issue of The Journal.

The branch has since been advised of Mr. Webster's death from pneumonia on February 4th, after only a few days' illness. As he was a valued friend of several members of the branch and had so recently visited us, a resolution of regret at this untimely event and of sympathy for Mrs. Webster was passed at the meeting of February 10th, 1927.

The Hemmings Falls Development

At a meeting of the branch held in the Chamber of Commerce council chambers, January 27th, 1927, J. S. H. Wurtele, M.E.I.C., vice-president and plant manager of the Southern Canada Power Company, Limited, delivered a most comprehensive and educational address on the Hemmings Falls development on the St. Francis river in Quebec.

His address was of peculiar interest to those present, as most of the equipment and machinery used in the development was supplied by the local factory of the Canadian General Electric Company.

The speaker of the evening was introduced by Max Sauer, M.E.I.C., who officiated as chairman for the occasion.

Illustrating his address with a variety of interesting views and diagrams showing the arrangement of the machinery, Mr. Wurtele entered into considerable detail regarding the activities of his company in that section of Quebec.

Mr. Wurtele was assisted at the lantern by H. S. Grove, A.M.E.I.C.

The thanks of the members was ably expressed to the speaker by A. L. Killaly, M.E.I.C. An abstract of this paper appears on another page of this Journal.

Students' Night

The meeting of February 10th, 1927, was devoted to a special "Students' Night," at which, under the able chairmanship of G. H. Burchell, S.E.I.C., the following three Students gave interesting papers:—

S. O. Shields. "Full Voltage Starting of Induction Motors."

W. T. Fanjoy. "Control of A. C. Motors."

F. J. Stewart, "Some Interesting Facts About Northern Alberta."

Mr. Shields introduced the subject of "Full Voltage Starting of Induction Motors" by drawing attention to the increasing demand for simplicity of control and operation of machines leading to a tendency to omit accessories such as starting compensators. He then pointed out that although the use of a starting compensator was intended to reduce the starting current and stresses on the windings of the motor, under certain circumstances, incorrect manipulation of the compensator could impose transients causing greatly increased stresses. A consideration also in some cases is the saving in space by the omission of a starting compensator.

Using the nomenclature adopted by the Canadian General Electric Company for their motors, Mr. Shields then described the general features of the following four classes of motors.

(1) Type KTE, with a high resistance, brass winding on the rotor, suitable for intermittent duty requiring high starting torque, such as elevator service.

(2) Type KTR, similar to the type KTE but with a lower resistance rotor winding, suitable for continuous running in service having a lower starting torque requirement.

(3) Type FTR, with composite rotor winding, consisting of copper bars at the bottom and brass bars at the top of the slots, separated by steel and copper bars. These are not general purpose motors, but are intended for applications requiring a high starting torque with moderate starting current when the motor is thrown directly on the line voltage.

(4) Type FT differs from the type FTR in having shallower slots with only a copper winding at the bottom of the slots and the top filled by steel bars. These motors are suitable for full voltage starting, but have a much lower starting torque than the type FTR. Suitable applications for this type are centrifugal pumps, fans, etc.

Control of A. C. Motors

In describing the various types of control for A. C. motors, W. T. Fanjoy, S.E.I.C., referred to control for squirrel cage and wound rotor induction motors suitable for starting, reversing and speed regulating, and for either hand, semi-automatic, or full automatic operation.

Reduced voltage starting is usually accomplished by means of a compensator or tapped auto transformer, having two or more reduced voltage taps and rated one minute in every four minutes for one hour. Compensators may be controlled either manually or by the use of contactors.

Other methods of reduced voltage starting are the resistor method, suitable for light duty, and inferior to the compensator method in that a higher current is drawn for the same torque; the reactance method, similar to the resistor method but more expensive; and the Y-delta method, which is equivalent to using 58 per cent starting tap, but has the same torque limitations as the resistance method. This latter method is not common owing to the fact that many motors have Y-connected windings and are, therefore, not suitable.

Mr. Fanjoy then referred to the full voltage starting of induction and synchronous motors, either by hand switch, magnetic switches, or breakers. He also referred to the starting and control of wound rotor induction motors and the various devices included in the control for protection against overload, undervoltage and phase failure, or reversal.

Some Interesting Facts About Northern Alberta

The third paper of the evening was given by F. J. Stewart, S.E.I.C., his subject being "Some Interesting Facts about Northern Alberta." Mr. Stewart described a trip made into this territory in 1922 which proved to be most instructive. During the course of the paper a large number of coloured slides were shown. The buffalo ranges, north of the Peace river and west of the Slave river, were described and several good photographs of these animals were shown. The speaker also covered the extensive mineral resources, such as galena, gypsum, salt and bitumen, of which there are many evidences, as well as the timber resources.

Development of these resources will only come with a solution of the power and fuel problems. Power sites were illustrated on the Slave river between Fitzgerald and Fort Smith, but it was pointed out that the nearest available coal supply was at Edmonton.

At the conclusion of each paper the speaker answered a number of questions. G. Coutts, A.M.E.I.C., proposed a vote of thanks to the three speakers, which was heartily approved by those present. In the absence of B. L. Barns, A.M.E.I.C., W. M. Cruthers, A.M.E.I.C., presented to G. H. Burchell, S.E.I.C., and each of the three speakers of the evening an Institute pin, donated by Mr. Barns for the first Students' papers to be given before this branch. This concluded a most interesting and entertaining evening.

Saskatchewan Branch

R. W. E. Loucks, A.M.E.I.C., Secretary-Treasurer.

Ladies' Night

The members of the branch, accompanied by their wives, spent a very enjoyable evening at the home of Mr. and Mrs. H. N. Macpherson, Regina, on Friday, January 7th, 1927. The early part of the evening was devoted to cards, followed later by refreshments and dancing. About sixty guests were present and all voted the function a huge success. Before leaving for home a vote of thanks was tendered Mr. and Mrs. Macpherson for their hospitality, after which the guests joined hands and sang "Auld Lang Syne."

Meeting of January 27th, 1927

A regular meeting was held in the Kitchener hotel on January 27th, preceded by a banquet. Chairman W. H. Greene, M.E.I.C., of Moose Jaw, presided. Following the banquet a unique form of spelling contest was staged by H. N. Macpherson, A.M.E.I.C., of the Entertainment Committee.

The Engineer and the Immigration Problem

A. G. Dalzell, M.E.I.C., consulting engineer of Toronto, Ont., gave a very instructive and interesting address on "The Engineer and the Immigration Problem." Mr. Dalzell declared that the engineer is responsible for the "Immigration Problem," as he had provided the modern means of overland and overseas transportation and facilitated electrical communication by telegraph, telephone and radio. The engineer should therefore rightly consider the problem and assist in its solution. Mr. Dalzell is of the opinion that we have in the past taken into western Canada immigrants more rapidly than they can be properly assimilated and they have been settled on the land without proper selection and supervision. The result is that a large number of farms are abandoned every year, and so long as this situation exists agriculturalists from northern Europe will not come to Canada. What is required is a proper survey and classification of our lands and soils and a correct invoice of our natural resources so that when settlers come to our shores they can be properly directed and advised in their settlement. Despite the fact that Canada is an agricultural country our urban population has increased in the past much more rapidly than our rural population, and this in spite of large numbers of immigrants arriving each year. There is a need to encourage and stimulate the populating of rural areas by assisting and directing the establishment of rural settlers. Past methods will not suffice. The cities of western Canada have been greatly over-subdivided without provision for settlement. Many of the errors of the past can be traced to speculators and the lack of proper control over subdivisions. These lands, whether urban or rural, must now be put to their proper use and in this the engineer can assist. He must carry on propaganda in public and take his rightful place in public life. The public do not appreciate the value of the engineer in directing the development of our cities, towns and rural areas. We should pay more attention to the human side of our development rather than the industrial and commercial, to strive to not only improve the tool, but improve the man who uses the tool.

At the conclusion of the address a hearty vote of thanks was tendered the speaker on motion of R. N. Blackburn, M.E.I.C., and H. S. Carpenter, M.E.I.C.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held on January 28th in the Y.W.C.A. rooms, following a dinner at which Mr. K. Gordon and Mr. R. Gascoigne of the Spanish River Pulp and Paper Company, and Mr. W. A. Burrows of the Turbine Equipment Company of Toronto, were the guests.

Owing to the absence of G. H. Kohl, A.M.E.I.C., chairman, and R. S. McCormick, M.E.I.C., vice-chairman, C. H. Speer, M.E.I.C., acted as chairman and called the meeting to order and expressed the feelings of all the members in extending to the visitors a hearty welcome.

At 8.15 p.m., after the completion of the regular business, the members, numbering thirty, under the guidance of Messrs. Dennison, Gordon and Gascoigne, made an inspection trip through the plant of the Lake Superior Paper Company. As the time was limited we started at the ground wood room inspecting the drum barkers and chippers, and then passed through the beater room on our way to the hydraulic and electrical grinder room. Great interest was shown here by the members. The next department visited was the paper machine room and the operation of the paper machines is still a conundrum to most of the members. From there we went through the sulphite mill and, to judge by the sneezing and coughing, the members thoroughly enjoyed this department. The board mill came next and we saw heavy wrapping paper being manufactured, and the smooth running steam plant of this part of the mill was well worth seeing. In the boiler house we had a chance to see the new pulverizing installation being installed and in the new power house the new turbo-generators and equipment were closely inspected by all. Last but not least came the corliss engines which supply power to the paper machines. The manner in which these engines are kept and operated shows that they are run by men who have a feeling for the machine they operate.

At 11 p.m., with a feeling that we would like to have had much longer to view the mysteries of paper making, the party broke up.

The executive wish to express their appreciation and thanks to the officials of the Spanish River Pulp and Paper Company for their courtesy in allowing the members of The Institute to go through the Sault plant and to thank those officials who so ably guided us through the mill.

Toronto Branch

J. W. Falkner, A.M.E.I.C., Secretary-Treasurer.
J. Hyslop, M.E.I.C., Branch News Editor.

At the regular meeting of the Toronto Branch on January 27th, 1927, a very interesting paper was presented by W. E. Bonn, A.M.E.I.C., on the subject of "Dredging."

Dredging

Mr. Bonn illustrated the various types of dredges in use, such as dipper, ladder and hydraulic types, describing the various classes of work for which each type was specially adapted. He dwelt at some length on the hydraulic dredge as used by the Toronto Harbour Commission, showing this machine filling in large industrial areas; he also described a new type of flexible joint for the discharge pipe line, this joint making it possible to lay a submerged pipe line so as not to interfere with navigation.

The paper was illustrated by many instructive lantern slides. At the end of the paper a discussion ensued, after which a hearty vote of thanks was extended to Mr. Bonn.

Inspection of New Testing Machine

At the conclusion of the above paper the meeting adjourned to the electrical building of the University of Toronto to witness tests on the new 400,000 pounds testing machine recently installed by the university. This machine is capable of testing beams 16 feet long and columns 10 feet long and is the largest of its type in Canada.

Speeches were delivered by Professor Peter Gillespie, M.E.I.C., who has had charge of the installation and arrangements; Sir Robert Falconer, president of the University of Toronto; T. A. Russell, a member of the Board of Governors, and Brig.-Gen. C. H. Mitchell, M.E.I.C., dean of the Faculty of Applied Science and Engineering, and A. T. Laing, associate professor of highway engineering. A number of slides illustrating the evolution of the testing machine were shown.

There were also present at this test Colonel Schwindin from Royal Military College, Kingston, and Professor Circe, from University of Montreal.

Concrete

At the regular meeting of the Toronto Branch on February 10th, 1927, a very instructive paper was presented by R. B. Young, M.E.I.C., on "Concrete."

Mr. Young touched in turn on the selection of raw materials, design of concrete mixtures, handling and measurement of materials and the manufacture of concrete. The selection of materials, he pointed out, was entirely an economic problem, uniformity of materials governing the quality of concrete. In designing the mix, different conditions of service require a different mix; two fundamental conditions must be met; first, requirement of the structure; second, the methods of manufacture.

Mr. Young then showed that the compressive strength of the concrete is related to the ratio of water to cement, the basic problem being to obtain the proper water cement ration and work ability simultaneously and continuously. A uniform mix is obtained only by absolute volume of cement aggregate and water, and if not abused will be uniform as to strength and other properties.

In measuring quantities the usual method is by volume, but this is liable to errors. An improved method on this is the use of some form of batcher. The inundation method provided a method of filling and eliminating the variations due to moisture, but not those due to grading. The weight method is a direct measure of its absolute volume so long as the specific gravity does not change.

In mixing, the standard recognized time is one minute after being placed in the drum. Good workmanship requires careful placing and that it be consolidated by paddling and pockets of coarse aggregate be prevented. Concrete must be properly cured to secure full advantage of its inherent possibilities.

The paper was well illustrated by slides, and at the end of Mr. Young's paper a vote of thanks was extended to him.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

Tuesday, January 25th, was a busy day for the members of the Saint John Branch of The Engineering Institute of Canada. The several events were held in the Admiral Beatty Hotel, as follows:—

3 p.m.—Annual meeting of Association of Professional Engineers of the Province of New Brunswick.

6 p.m.—Joint dinner, Association of Professional Engineers of the Province of New Brunswick and Saint John Branch of The Institute.

8 p.m.—Public meeting, Saint John Branch of The Institute.

Annual Meeting Association of Professional Engineers of New Brunswick

At the annual meeting the usual hearing and passing of reports and other incidental business was disposed of. Alex. Gray, M.E.I.C., presided over the meeting until the new officers were announced, when Geoffrey Stead, M.E.I.C., newly elected vice-president, took the chair in the absence of J. D. McBeath, M.E.I.C., newly elected president. The officers of the Association for 1927 are as follows:—

Past President	Alex. Gray, M.E.I.C., Saint John
President	*J. D. McBeath, M.E.I.C., Moncton
Vice-President	*Geoffrey Stead, M.E.I.C., Saint John
Councillors, Saint John District	S. R. Weston, M.E.I.C., Saint John
	*J. P. Mooney, A.M.E.I.C., Saint John
Councillors, Moncton District	G. C. Torrens, A.M.E.I.C., Moncton
	*F. Williams, A.M.E.I.C., Moncton
Councillor, Chatham District	W. R. Campbell, Campbellton.
Councillor, Fredericton District	Prof. J. Stephens, M.E.I.C., Fredericton
Auditors	*J. R. Freeman, M.E.I.C., Saint John
	*J. N. Flood, A.M.E.I.C., Saint John
Secretary-Treasurer	J. A. W. Waring, A.M.E.I.C., Saint John

* Elected at Annual Meeting, January 25, 1927.

Joint Dinner

The joint dinner of the Association of Professional Engineers of the Province of New Brunswick and the Saint John Branch of The Institute was a very enjoyable affair. A. R. Crookshank, M.E.I.C., chairman of the Saint John Branch of The Institute, presided, and on his right had as guest of honour, Alex. J. Grant, M.E.I.C., of St. Catharines, Ont.

Branch Meeting

The large attendance at the branch meeting was indicative of the interest in the subject,—the Welland Ship Canal,—as described by Alex. J. Grant, M.E.I.C., engineer-in-charge. The historical facts, dimensions and depths of three earlier canals across the Niagara peninsula, and the dimensions of the present canal now under construction, were thoroughly described. By a large number of lantern slides, the speaker showed various stages of construction in different sections of the new canal.

A vote of thanks was extended to Mr. Grant by A. R. Crookshank, M.E.I.C., on motion of Geoffrey Stead, M.E.I.C., and H. F. Morrisey, A.M.E.I.C.

Victoria Branch

K. M. Chadwick, M.E.I.C., Secretary-Treasurer.

Town Planning

Through the kind invitation of the British Columbia Land Surveyors' Association, members of the Victoria Branch were invited on January 11th, 1927, to hear a lecture by Horace L. Seymour, M.E.I.C., president of the Town Planning Institute of Canada, on "Town Planning." The lecturer said that town planning provides a centralized municipal control over development that is lacking in most municipalities. The Town Planning Act made it possible for the solution of problems of an intricate nature.

Town planning he regarded not only as effecting a system of arterial highways, matters of transit, transportation and provision for parks, but as a means of rationally controlling the whole development of a city so that "work" and "home" might be happily related.

There must be public support in order to have an effective system of town planning. Legislation is pending in British Columbia, according to the speaker, which would be most advantageous to the advocates of town planning. In conclusion, he said that Victoria should be careful to give consideration to every element of the town planning system, without which no zoning methods would be really successful.

J. A. Walker, A.M.E.I.C., secretary of the Vancouver City Town Planning Commission, gave a brief history of the development of town planning in that city.

Meeting of January 13th

On January 13th the Victoria Branch entertained Mayor Carl C. Pendray of Victoria at luncheon at Spencer's dining rooms.

After the luncheon E. Davis, M.E.I.C., chairman of the branch, in rising to introduce Mayor Pendray, spoke of his excellent service for two years, and drew attention to the fact that he was now entering on his third year of service to the city. He dealt with the growing industrial developments of the west coast of the island, pointing out that 141,000 cases of salmon, 1,900,000 gallons of fish oil, and 43,000 cases of salt fish had been shipped from the west coast last year, in addition to the shipments of the vast lumber industry.

Mayor Pendray spoke of the industrial possibilities of Victoria, pointing out that much of the shipping that was at present passing by Victoria from the west coast of the island and other points could be economically handled from here.

His Worship dealt with the cost of moving grain, etc., by rail and water, and quoted figures to show that an actual saving could be made by the use of Victoria for exporting certain articles.

A hearty vote of thanks was extended to the mayor on the motion of P. Philip, M.E.I.C., Deputy Minister of Public Works.

The members also welcomed to the gathering Major George A. Walkem, M.E.I.C., president of The Engineering Institute and representative in the provincial legislature for the constituency of Point Grey. Major Walkem addressed the meeting briefly, stating he had always taken an interest in Victoria and was glad to hear of its improved financial condition and good prospects as a port.

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor

An interesting address was delivered by B. L. Thorne, M.E.I.C., to the branch on January 20th on the subject of "Mining at Kimberly and Smelting Operations at Trail, B.C."

Mining at Kimberly and Smelting Operations at Trail, B.C.

In his initial remarks Mr. Thorne outlined quite comprehensively the history of the mining industry in this area, which virtually started in 1892 on Mark creek, twenty miles north of Cranbrook, now known as the famous Sullivan mine. A branch railway was built in 1899, and in 1903 a smelter was erected at Marysville for the treatment of lead ore. The ores in this locality are of a very complex variety and consequently the best methods of concentrating and smelting formed a difficult problem. Between 1910 and 1915 some 188,000 tons of picked ore were shipped and smelted in the plant of the Consolidated Mining and Smelting Company, which was first incorporated in 1906. Development was carried on by the company on a highly systematic basis in a thoroughly proven ore body of high grade quality. In 1925 the tonnage treated at Trail amounted to 340,710 tons from company's mines and 39,570 tons from custom shippers, or a total of 380,280 tons. The total tonnage in 1926 is given as approximately 560,000 tons. The production for 1925 was approximately as follows: gold, 21,352 oz.; silver, 4,397,455 oz.; copper, 950 tons; lead, 117,504 tons; zinc, 48,611 tons; the value of these products being close to thirty million dollars as compared with seventeen million dollars in 1924.

Mr. Thorne explained that the process has been much improved since 1920, when the differential flotation method of extraction was first adopted. He mentioned that the plant covers an area of 250 acres and includes plants for lead-smelting, copper-smelting, zinc treatment with electrolyte, electrolytic lead, copper, and gold refineries, plants for hydrofluoric acid, bluestone, and sulphuric acid recovery, modern machine shops and foundries in which all mechanical appliances used in the concentrator and reduction plants are manufactured.

Some 52,000 horse power of electrical energy are taken from the West Kootenay Power Company, at Bonnington Falls, a subsidiary company of the Consolidated Mining and Smelting Company.

The Sullivan ore body is peculiar in that it is divided into two distinct sections with a large body of iron ore in between. This latter is all important in the blast furnace operations for zinc, as with the proper proportions of iron those ores containing a high percentage of zinc can be readily oxidized with the elimination of sulphur, which minimizes furnace troubles. This mine, the speaker went on to say, has produced five million tons of ore to date. He also stated that the Trail smelter treats the most diversified ores on this continent, also that the rated capacity of the zinc plant alone is 275 tons a day, and the total ore treated amounts to 3,000 tons a day and the plant is being enlarged to handle 4,000 tons.

With the aid of two reels of moving pictures kindly loaned by the Canadian Pacific Railway, the audience were taken through the many sections of the plant and the mines, and were able to follow the different phases of the work and the processes of treatment of the ores from the reception from the mine down to the actual handling of the gold and silver bricks and the many other metallic products such as lead pipe and copper rods. There were shown tank rooms for recovery of lead by electrolytic process on the cathode sheets, and of gold and silver on the anode plates.

The above are a few of the outstanding features explained by Mr. Thorne. There were many other points dwelt upon, largely statistical, which, with the pictures shown, resulted in a most interesting address.

C. C. Richards, M.E.I.C., moved a vote of thanks to the speaker, which was very heartily endorsed by all present. Chairman J. H. Ross, A.M.E.I.C., took the opportunity of emphasizing the thanks of the branch to Mr. Thorne for his instructive and interesting address.

The Coming Biological Age

"The Coming Biological Age" was the subject of a lecture delivered by Dr. R. W. Boyle, M.E.I.C., before the branch on February 4th. In presenting his subject the speaker warned his hearers that indulging in prophecy was of a somewhat gloomy and speculative strain. His declaration that our present mechanical civilization will decline and will be superseded by an age when the major concern of the human family will be biological, was startling to say the least. His principal contention was that the great effort would be to support vast populations on a too limited soil. On commenting on the present age, which is conceded to be the mechanical age, he stated that it had produced a reign of freedom more pronounced than any previous age. Machines have multiplied and not decreased labour, as many had imagined. It took probably some 400 years to build up this mechanical age. The question was, will it last? It was the speaker's endeavour to prove that the answer was in the negative. Dr. Boyle outlined his arguments in very clever sequence, and with a conviction that such changes would eventually come about, but in the nature of things these changes would undoubtedly be extremely gradual. He pointed out that there was not much difference between socialism and capitalism, and that here in Alberta the farmer was the most conservative and the least radical man. The individual, he was sure, played a smaller part today in the world than ever before, due to the prevalence of committees, associations, conventions, organizations, etc. He emphasized that while mechanics evolved rapidly, man's brain moved comparatively slowly, and that a change must take place in the not too far distant future when trade and tariff wars must occur, food prices rise and agriculture find its own and predominate, and mechanical industrialization will of necessity outrun itself. Today, he said, mechanical civilization depends on the metals, and an exhaustion of these must some day come about, and when metals fail industrialization fails.

Referring to oil, Dr. Boyle pointed out that this commodity holds a most conspicuous position amongst minerals, at the same time declaring that oil would most likely peter out before coal, and also that in his opinion water power will never be a source of lasting power.

He ventured to offer a solution of the problem of exhausted metal supplies by a scientific discovery of a method to separate electrons from matter and reconstitute or reconstruct them to form or recreate metals, but this would no doubt be at prohibitive cost.

It was interesting, he stated, to note that in the early period of Grecian history a well-to-do Greek would probably possess about forty slaves, whereas today in the United States, where some 500,000,000 horse power is in use, each individual has, roughly speaking, the equivalent man-power of about fifty slaves working for him—indeed, an age of mechanical luxury. He referred to the fact that, in the United States in particular, machines are today turning out more goods and commodities than the people can normally use, and consequently manufacturers are forced to create a larger demand. To do this they have had to resort to advertising on enormous scales, and also it has become necessary to invade foreign markets, which has created amongst the less conspicuously commercial nations a keener competition.

Dr. Boyle's argument was primarily that metals, and consequently machines, will cease to be, and man will therefore be forced to retire to a simpler life, eventually returning to the soil. It is in this way that the soil will gradually limit the earth's population. There will, however, be a period before the disappearance of machines when people will flock from the country to the cities to an increasing extent, until such times as the demand for agricultural products will increase enormously and prices rise. It is at this period that the mechanical age will decline and when cheaper food will be demanded. Activities in mining operations will increase on a highly intensive scale, ores previously discarded as worthless being treated again under advanced scientific methods. Coal reserves will become exhausted and the decline of mechanical industrialism will drive the population back to the primitive life,—certainly a somewhat gloomy vision to consider.

P. J. Jennings, M.E.I.C., moved a very warm vote of thanks to Dr. Boyle for his exceedingly interesting address and expressed a hope that the art of soap-making would not be lost during our lifetime at least, which might be assumed as a possibility according to some remarks of the speaker.

In the absence of the chairman, J. H. Ross, A.M.E.I.C., the vice-chairman, F. K. Beach, A.M.E.I.C., took the chair, and expressed the thanks of all present and of the branch in general, for the very able and cleverly thought-out address.

Preliminary Notice

of Applications for Admission and for Transfer

February 16th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in March 1927.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

CALLANDER—DELMER WALLACE, of Hamilton, Ont., Born at North Gower, Ont., Jan. 4th, 1887; Educ., B.Sc., McGill Univ., 1911; 1909-12, engrg. apptceship course, Can. Westinghouse Co.; 1912-21, engrg. dept., electrical design of a.c. and d.c. motors and generators; 1921 to date, Can. Westinghouse Co., transformer design.

References: H. U. Hart, W. F. McLaren, C. V. Christie, E. D. W. Courtice, J. H. Trimingham, P. S. Gregory.

ELKINS—WILLIAM HENRY PFERINGER, of Ottawa, Ont., Born at Sherbrooke, Que., June 13th, 1883; Educ., diploma, R.M.C., 1905; Lieut. R.C.H.A. 1905-; 1908-10, served in India with R.H.A., promoted Captain, 1910; 1913-14, gunnery staff course, England; 1914-19, served overseas; Feb. to Dec. 1916, commanded A. Battery, R.C.H.A., in France; 1916 to end of war, commanded R.C.H.A. Brigade, returning to Canada in command of brigade; 1920-22, commandant, Royal School of Artillery (mobile); 1922-25, commandant, Royal School of Artillery (coast defence and anti-aircraft); 1925-26, commandant, Royal School of Artillery (mobile); at present, staff officer, artillery, headquarters, National Defence; chairman, Standing Arms Committee.

References: A. C. Caldwell, E. Forde, J. B. Cochrane, P. DeL. D. Passey, S. H. Osler, H. L. Sherwood, E. J. C. Schmidlin, J. L. H. Bogart, K. M. Perry, A. G. L. McNaughton.

GALLER—LEO, of Montreal, Que., Born at Jaroslaw, Poland, July 31st, 1891; Educ., C.E., Vienna (Austria), 1917; after graduation from University, employed by Dr. Porades Constrn. Co. in Vienna as supt. on constrn. until 1921; 1921-23, supervising, surveying and bldg. of railroads on the estate of Duke Crastoryski in Poland; 1923-25, in partnership Birdawa. Constrn. Co. in Jaroslaw; Jan. 1925 to Jan. 1927, civil engr. with Atlas Constrn. Co.; at present, designing engr. with Montreal Water Board Comm'n.

References: C. M. Morssen, C. J. Desbaillets, J. F. Brett, P. Bailey, W. Dickson, A. Leroux.

GILBERT—EDWARD JAMES, of Regina, Sask., Born at Petrolia, Ont., Dec. 15th, 1889; Educ., public school and collegiate, final examination, Sask. Assn. of Architects, 1921; 1908, dftsman, Dept. of P.W., Sask.; 1909-10, dftsman, Dept. of Telephones, Regina; 1912, dftsman, Smith & Phillips, surveyors, with some field work; 1915, asst. engr. on six drainage schemes under C. S. Cameron; 1916-19, war service with Can. Engrs.; 1919 to date, engrg. in connection with provincial gov't. bldgs. in Sask., including investigating possible sites and locating and setting at proper levels to obtain fall to city sewers or other outlets; at present, field engr. and acting prov. architect, Dept. of P.W., Sask.

References: M. U. Sharon, E. W. Murray, D. A. Smith, C. S. Cameron, R. W. E. Loucks, H. N. MacPherson.

HALL—FREDERICK WILLIAM, of London, Ont., Born at St. Thomas, Ont., Nov. 19th, 1893; Educ., St. Thomas Collegiate Institute; 1913-14, dftsman and apptce. instructor with Michigan Central R.R., St. Thomas; 1914-19, war service overseas; 1919, mech. engr. with M.C.R.R.; 1919-20, dfting instructor, Tech. School, St. Thomas; 1920 to date, with Richards Wilcox Canadian Co. Ltd., as dftsman and at present, engr. i/c dfting and designing.

References: W. C. Miller, W. M. Veitch, G. H. Chalmers, E. V. Buchanan, R. W. Garrett, W. P. Near.

HICKS—ARTHUR MONTAGUE of Three Rivers, Que., Born at Brotton, England, May 21st, 1878; Educ., Middlesborough High School; commenced work in the lab. of Bell Bros. chemical works, Port Clarence, and later became shift chemist; 1903-20, on staff of Ed. Bennis & Co. Ltd., one of the leading structural and combustion engrg. cos. in Gt. Britain, i/c of testing dept. of this Co. for 10 yrs., i/c research work regarding this Co.'s mechanical stoking apparatus for all classes of boilers and conducted all important boiler trials, also acted as works chemist and installed and operated all apparatus necessary for testing and classifying of various fuels; 1920 to date, ch. engr., Wayagamack Pulp & Paper Co. Ltd., Three Rivers, Que.

References: J. T. Farmer, S. W. Slater, F. A. Combe, H. T. Doran, J. S. Costigan, G. M. Wynne, F. O. White.

LINK—NORMAN ARCHIBALD, of Regina, Sask., Born at Lethbridge, Alta., Sept. 2nd, 1893; Educ., 4 yrs. high school, Lethbridge, Alta.; 1913-14, chainman and rodman, C.P.R.; 1916-19, overseas, C.E.F.; 1919-26, with C.P.R., as, 1919-20, transitman, ry. location; 1921, instrumentman, mtce.; Feb. to Sept. 1922, transitman, ry. location; 1922-23, bridge and bldg. inspector on timber trestles and terminal bldgs.; 1923-26, res. engr. i/c ry. grading and ballasting; Mch. to Oct. 1926, locating engr. i/c location surveys; Nov. 1926 to date, general contracting business.

References: W. A. James, J. R. Paget, J. G. Reid, A. E. Sharpe, C. H. Larson.

MacKAY—JAMES ARTHUR, of Bedford, N.S., Born at Truro, N.S., Jan. 9th, 1885; Educ., B.Sc., N.S. Tech. Coll., 1911; 1908-09 and 10, asst. erector with Maritime Bridge Co. at New Glasgow on bridge and bldg. replacement and erection during summers; 1911-12, with same firm as dftsman on general detail work, estimating and designing; 1912-15, res. engr. with C.P.R. on Dom. Atlantic Ry. i/c reconstrn. of Avon River Bridge at Windsor, Ont.; 1915-18, asst. engr. with Dom. Atlantic Ry. on general mtce. and constrn. at Kentville, N.S.; 1918 to date, asst. engr. with C.N.R. on staff of division engr. of Halifax division.

References: R. A. Black, J. H. Clark, H. W. L. Doane, K. L. Dawson, W. H. Noonan, R. W. McColough, C. H. Wright, G. S. Stairs.

PAINE—NATHAN DEANE, of Kenogami, Que., Born at Berlin, N.H., Apl. 19th, 1892; Educ., B.S., New Hampshire Univ., 1913; 1913-15, electrical repairs with Brown Corp., Berlin, N.H.; 1915-16, operation and repairs, Northern Ohio Traction and Light Co., Akron, Ohio; 1916 to date, with Price Bros. & Co. Ltd. as, electrical foreman, 6 years, supt. electrical operation, 3 years, and general electrical supt., Kenogami.

References: W. G. Mitchell, A. A. MacDiarmid, C. N. Shanley, G. H. Kirby, G. E. LaMothe.

POWER—EDMUND DE GASPE, of Quebec, Que., Born at Ottawa, Ont., Mch. 27th, 1888; Educ., McGill Univ., 1909-10, civil engrg.; matriculant registered civil engr., B.C.; 1906-07, rodman and level, Nat. Trans. Ry. local surveys; 1907-08-09, signalman, recorder and reconnaissance, Can. Geodetic Survey; 1911-12, instrumentman, Vancouver Engrg. Dept., pavements, roads, sewers; 1912-13-14, engr. for Tacoma Dredging Co., constrn. Lake Washington canal, East waterway and docks, river control, tide land reclamation in State of Washington, U.S.A.; 1914-15-16, track engr., C.N.R.; 1916-17-18, plant engr., John Coughlan and Sons, slipway and ship constrn., plant and bldgs.; 1918-19-20, contracting engr., private practice; at present, vice-president and mgr., Prov. of Que., of The Dredging Contractors Ltd., contractors for dredging and filling Wolfe's Cove terminals, reclaiming tide flats for Anglo-Can. Pulp Co.

References: F. L. Fellowes, A. S. Wootton, E. A. Wheatley, G. A. Walkem, L. F. Merrylees, T. L. Tremblay, H. L. Trotter, T. S. Connell.

ROSS—ROBERT BRUCE, of London, Ont., Born at Embro, Ont., Sept. 11th, 1881; Educ., matriculation, Woodstock Collegiate Institute; 1907-14, contractor and mgr. bridges, dams and breakwaters; 1908-27, Ontario mgr., Milton Hersey Co. Ltd. i/c inspection of asphalt, concrete, pavements, dams, bridge abutments and paving materials.

References: W. P. Near, C. A. Mullen, W. M. Veitch, W. C. Miller, H. Craig, H. W. Patterson, A. B. Mauson, S. Shupe.

ST. GERMAIN—PAUL, of Montreal, Que., Born at Montreal, Dec. 10th, 1900; Educ., 3 yrs. at McGill Univ., electrical engrg. 1922; 1918 (summer), surveyor; 1919 (summer), telephone work; 1920 (summer), electrical winder; 1922 to date, with Mtl. Light Heat & Power Cons. on mtce. of storage batteries, installation of panels for high-tension transformers, installation of electric boiler for generating steam, installation of motor generator, motors, arc rectifier machines, I.C. machines, etc.; at present, supt. of electrical dept. (electric stations and outside transmission lines) on Montreal and Lachine canals.

References: L. H. Marotte, J. E. Lionais, E. J. Turley, L. L. O'Sullivan, R. M. Walker, J. M. M. LaForest.

TREGARTHEN—MARK ELMER, of Hull, Que., Born at Sydney, Australia, Sept. 27th, 1897; Educ., B.E. (mech. & elect.), Sydney Univ., 1921; 1916, 6 mos. naval dockyard experience; 1917-19, exped. force engrs.; 1921, foundry experience; 1922, erection experience; 1922-26, supt. of Electric Light & Power Supply Corp., Sydney, a supply company serving 10 sq. miles of congested suburban area with light & power; position entailed complete charge of street and district distribution from the time the electricity left powerhouse to the time it reached the consumers, staff consisted of 110 foremen, linesmen and helpers; at present, in Canada obtaining experience in high-tension transmission and substation work, having toured different plants of the B.C. Electric Co., the Ontario Hydro-Electric Commission, etc. Now working with Comstock Ltd. at Gatineau paper mill.

References: H. E. T. Haultain, G. N. Thomas, J. W. Falkner, J. H. Brace, F. C. C. Lynch.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

GRAHAM—ANDREW GEORGE, of Point Grey, B.C., Born at Ladysmith, S.A., Dec. 25th, 1887; Educ., civil engrg. course, Royal Tech. Coll., Glasgow, Scotland; 1903-08, pupilage with Kyle and Frew, Glasgow; 1908-11, asst. engr., engr's. office, Clyde Navigation Trust, Glasgow; 1911, asst. engr. on survey of Fraser River at New Westminster, B.C., under Capt. A. O. Powell; 1912, constrn. with Can. North. Pacific Ry. nr. Kamloops, B.C.; 1912-13, asst. engr. with city of New Westminster on design and constrn. of sewerage system; 1913-16, instrumentman and res. engr. with Pacific Gt. Eastern Ry.; 1916-19, overseas with Can. Field Artillery; 1919, instrumentman with Vancouver Hbr. Commnrs.; 1919-20, asst. engr. with municipality of Durnaby, B.C.; 1920-21, i/c constrn. reinforced concrete coal plant at B.C. Cement Works, Vancouver Island; 1921-24, res. engr., Takoradi Harbour Works, Gold Coast Colony; 1924 to date, asst. engr., municipality of Point Grey, B.C.

References: P. Philip, C. Brackenridge, C. R. Crysdale, A. E. Forman, A. S. Wootton.

ROBINSON—LEONARD HIRAM, of Campbellton, N.B., Born at Brockville, Ont., Sept. 4th, 1878; Educ., C.E., Univ. of Toronto, 1904; 1902 and 1903 (summers), instrumentman, Ont. Land Surveys; 1904-07, transitman, Nat. Transcontinental Ry., surveys; 1907-12, res. engr., constrn. of Nat. Trans. Ry.; 1913, location engr., C.P.R.; 1914-18, location engr., C.N.R.; 1919-26, div. engr. mtce. of way, C.N.R.

References: A. F. Stewart, F. O. Condon, C. S. G. Rogers, A. S. Gunn, M. J. Murphy.

WALL—ARTHUR STANFORD, of Montreal, Que., Born at Truro, N.S., June 23rd, 1885; Educ., civil engrg., Dalhousie Univ., 1904-08; 1907 (summer), on Halifax and Eastern Ry. survey; 1908-09, with Reid & Archibald, wharf and bridge bldrs., Halifax; 1909-10, on survey of the gypsum deposits of N.S.; 1910 to date, with Dom. Bridge Co. Ltd. as, 1910-12, detail dftsman; 1912-13, detail checker; 1913-20, designer on bridges, bldgs., penstocks, etc.; 1920-23, i/c design and constrn. of special platework; 1923-27, i/c plate and tank dept., constructing digesters, accumulators, volute casings, penstocks, etc.

References: F. P. Shearwood, P. L. Pratley, D. C. Tennant, A. Plamondon, F. Newell, H. S. VanPatter, J. A. McCrory.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

HENRY—THOMAS HALIBURTON, of Montreal, Born at Montreal, Aug. 17th, 1892; Educ., B.Sc., McGill Univ., 1914; overseas, 7th C.G.A., to May 1919; 1919-20, clerk, car service dept., C.P.R.; 1920-21, dftsman, T. Pringle & Son; 1921-23, engr., cross sections and quantities for J. P. Porter Standifer and Porter Bros.; 1923-24, engr. i/c survey at Godbout and Corner Brook, Nfld., for W. I. Bishop Ltd.; 1924-25, engr. for Fraser Brace, Deer Lake, Nfld.; Jan. to Mch. 1925, survey at Murray Bay, H. T. Taylor; Mch. to July 1925, engr. on paper mill, Riverbend, for W. I. Bishop Ltd.; July 1925 to Jan. 1926, asst. supt., W. V. Murray, on bldg. at Princeton, N.J.; Jan. to Nov. 1926, supt., A. F. Byers & Co. Ltd.; Nov. 1926 to Jan. 1927, res. engr., Spruce Falls Pulp & Paper Co.; at present, supt., A. F. Byers & Co. Ltd.

References: A. F. Byers, C. E. Fraser, S. S. Shector, G. M. Wynne, R. E. Jamieson, A. L. Patterson, C. McL. Pitts.

LAWSON—WILLIAM JOHN, of Fredericton, N.B., Born at Hopewell Hill, N.B., May 26th, 1894; Educ., Univ. of N.B., B.Sc., 1915; 1914-19, overseas, Lieut., C.F.A.; 1920-21, dftsman, instrumentman and ch. of party, highway surveys, Dept. of Public Works, Fredericton, N.B.; 1921-26, resident engr. i/c Highway Construction Dept. of P.W.; 1926 to date, locating engr. for same dept.

References: B. M. Hill, S. R. Weston, L. L. Theriault, G. H. Lowry, M. W. Black, W. J. Johnston, J. Stephens.

SIMPSON—BRUCE NAPIER, of York Mills, Ont., Born at Toronto, Oct. 13th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1914; Lieut's certificate, C.F.A.; 1911 (summer), foreman on rock disposal, Creighton Mine, timekeeper and asst. to mine supt., Crean Hill Mine; 1912 (summer), rodman and asst. on camera surveying party of Geological Survey in B.C.; 1913 (summer), instrumentman i/c party, city of Toronto, field asst. commn. of conservation reconnaissance survey, making report on water power on the coast of B.C.; field asst. to Mr. N. R. Gibson, making survey and report for storage scheme in connection with water power development in Northern Ont.; 1914-15, office asst., Comm. of Conservation on Lake of Woods report; 1915, inspector for city of Toronto on concrete work, roads, sidewalks, etc.; 1915-17, Lieut. in C.F.A., C.E.F.; 1917-18, office asst., H.E.P.C., hydrometric work and gathering of hydrographic data; 1919, personal asst. to Mr. T. H. Hogg; 1922 to date, engineering secretary, hydraulic dept.

References: F. A. Gaby, N. R. Gibson, T. H. Hogg, H. G. Acres, A. E. Nourse, R. L. Hearn.

WHITFORD—JOSEPH ARTHUR HUGH, of Moncton, N.B., Born at Bridgewater, N.S., July 22nd, 1899; Educ., Jr. matric., Bridgewater High School, 1915; I.C.S. course architecture; 1914 and 15 (summers), chainman and rodman, N.S. Prov. Highway Surveys; June to Dec. 1917, signaller, 10th Siege Battery, C.E.F.; 1917-19, gunner with 39th C.F.A., France; Mch. to June, 1919, rodman and dftsman for town engr., Bridgewater, N.S.; June to Dec. 1919, chainman, and, 1919-21, rodman for div'n. engr., C.N.R., Bridgewater, making small land surveys, searching records, borings for bridge foundations, detail measurements of wharves and other ry. structures; at present, dftsman on bldg. design under bldg. engr., constrn. plans, inc. plumbing and heating for all types of ry. bldgs., C.N.R., Mocton, N.B.

References: A. F. Stewart, F. O. Condon, H. J. Crudge, C. S. G. Rogers, A. C. Selig, F. B. Fripp, A. S. Gunn, J. G. Dryden.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

BYRAM—ARTHUR TENNYSON, of Toronto, Ont., Born at Smiths Falls, Ont., May 9th, 1897; Educ., B.A.Sc., Univ. of Toronto, 1923; May 1st, 1923, to date, asst. engr. with Dept. of Health, inspections and reports on sources of water supply, sewage disposal systems, stream pollution, typhoid epidemics, regular inspection municipal chlorination plants in the province, sanitary surveys of 50 municipalities, bacteriological and chemical analysis of water and sewage, dfting, inspection of waterworks pumping stations and an annual inspection of 35 tourist camps.

References: F. S. Keith, A. E. Berry, P. Gillespie, C. H. Mitchell, J. B. C. Keith.

CAMPBELL—WILLIAM A., of Toronto, Ont., Born at Durham, Ont., Nov. 8th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1922; B.A., Queen's Univ., 1916; 1921, 3 mos. fuel engr., Algoma Steel Corp., Sault Ste. Marie; 1922 to date, with Bakelite Corp. of Canada as chief chemist and factory manager.

References: E. E. Litz, R. W. Angus, T. R. Loudon, C. Breithaupt.

DAVIES—EWART JOHN, of Galt, Ont., Born at Whitney, Ont., June 19th, 1898; Educ., B.Sc., N.S. Tech. Coll., 1923; machinist apptce., July 1915 to Apl. 1917 and Jan. to Oct. 1919; 1920 (summer), machinist; 1921 and 1922 (summers), mechanical constrn., Dom. Coal Co., Glace Bay; 1917-19, mechanic (fitter, turner and engine tester), R.A.F.; 1923 to date, with Babcock-Wilcox and Goldie-McCulloch Ltd., Galt, Ont., dfting, 3 mos., boiler erection, 3 mos., sales estimating and price adjusting. Term 1922-23, asst. instructor, machine tool operation, evening tech. classes, Halifax, N.S.

References: D. W. Munn, F. R. Faulkner, W. F. McKnight, G. H. Dickson, R. E. MacAfee, J. O. Twinberrow.

GAUTHIER—J. P. RENE, of Outremont, Que., Born at St. Eustache, Que., July 18th, 1895; Educ., C.E. and B.A.Sc., Laval Univ., 1916; 1916-23, with Que. Streams Commn., asst. engr. on water power surveys, on survey party, asst. to engr. i/c construction of La Loutie dam, i/c field party on Lake St. Francis and upper St. Maurice surveying flooded land, office work estimating Kenogami dams; 1923 to date, with Dom. Water Power Branch as asst. engr. to chief Quebec district engr.

References: O. O. Lefebvre, J. G. Denis, A. Duperron, H. Massue, J. F. Guay.

HARVIE—ALLIN C., of Port Colborne, Ont., Born at Peterborough, Ont., Jan. 6th, 1900; Educ., B.Sc., Queen's Univ., 1923; 1920 and 1921 (summers), machinist helper, Govt. grain elevator, Port Colborne; 1923 to date, inspector on constrn. work, instrumentman and dftsman, engrg. dept., Int. Nickel Co. of Can. Ltd.

References: G. M. Hamilton, A. Ferguson, L. M. Arkley, L. T. Rutledge.

MacISAAC—VERNON W., of Cornwall, Ont., Born at Bervie, Ont., Mar. 15th, 1891; Educ., B.Sc., Queen's Univ., 1921; previous to 1917, 3½ yrs. practical bldg., mechanic foreman, supt., and 1½ yrs. machine shop work, with Booth paper mills; 1917, 8 mos. dftsman, Deloro Smelting & Refining Co., Deloro, Ont.; 1918-19, asst. to ch. engr., Deloro Smelting & Refining Co., for 5 mos. acting ch. engr.; 1920, 6 mos. mill design, Brompton Pulp & Paper Co., East Angus, Que.; 1921-23, designing and service engr., Dodge Mfg. Co.; 1923, asst. to ch. engr. in all branches of plant engrg. constrn., improvement and mtce., Howard Smith Paper Mills, Cornwall, Ont.; 1924 to date, ch. engr., Howard Smith Paper Mills, Cornwall, Ont.

References: F. O. White, G. L. Guillet, C. D. Sargent, W. H. Magwood, F. Stidwell, R. L. Yuill.

McCULLOCH—ORVAL JAMES, of St. Catharines, Ont., Born at Carleton Place, Ont., Mar. 28th, 1894; Educ., B.Sc., McGill Univ., 1917; 1917-18, dftsman in office of ch. engr., C.N.R., Montreal; March to May 1918, dftsman, Shawinigan Water & Power Co., Montreal; 1918-20, dftsman, working on design and constrn. of nickel refinery of Brit. Am. Nickel Corp. at Deschenes, Que.; May to Nov. 1920, shift foreman in nickel refining dept. of refinery of same Co.; 1920-21, dftsman with Riordon Co. Ltd. at Mattawa on design of pulp mill at Temiskaming; 1921 to date, with Welland Ship Canal, Dept. of Rys. and Canals, St. Catharines; 1921-23, senior dftsman 1923-25, asst. engr; 1925 to date, asst. structural engr.

References: A. J. Grant, E. G. Cameron, F. E. Sterns, M. B. Atkinson, J. B. McAndrew, G. Kydd, R. L. Peck.

McLAREN—LEO G., of Hebertville, Que., Born at Chicoutimi, Que., Sept. 12th, 1898; Educ., B.A., Laval Univ., 1920, B.Sc., McGill Univ., 1924; 1924 to date, with Shawinigan Engrg. Co. on various constrn. and preliminary survey works; Apl. to Oct. 1926, ch. of party locating northern half of transmission line from Isle Maligne to Quebec; at present, ch. of engrg. party on constrn. of same.

References: S. Svenningson, C. R. Lindsay, C. Luscombe, H. Dessaules, E. Wilson, P. Chapleau, E. Brown.

PEVZNER—DAVID ISIDORE, of Outremont, Que., Born at Taganrog, Russia, June 29th, 1899; Educ., B.Sc., McGill Univ., 1922; 1917-18, inspector, Steel Co. of Can.; 1918, B. J. Coghlin Co. Ltd.; 1922 to date, structural and mechanical engrg. with C. D. Goodman, architect, also i/c erection supervision.

References: H. M. Goodman, N. C. Cameron, C. J. Leblanc, A. J. Kelly, E. W. Wait.

RAPLEY—BLAKE P., of Sarnia, Ont., Born at Strathroy, Ont., Nov. 12th, 1899; Educ., B.Sc., Queen's Univ., 1923; May to Aug. 1923, asst. to master mechanic, Can. Carborundum Co., Shawinigan Falls; Aug. to Oct. 1924, dftsman, Nfld. Power & Paper Co.; 1924-25, asst. i/c of moving equipment from storage to site of erection, in mill equipment dept. of same Co.; 1925-26, mill storekeeper of same Co.; 1926 to present, dftsman, Imperial Oil Refineries Ltd.

References: L. M. Arkley, L. T. Rutledge, T. Montgomery, J. Stadler, D. A. Evans, R. L. Weldon.

WEBB—HARRY RANDELL, of Edmonton, Alta., Born at Lucan, Ont., Jan. 13th, 1900; B.Sc., 1921, M.Sc., 1922, civil engrg., Univ. of Alta.; May to June 1919, rodman on drainage with Govt. of Prov. Alta.; July to Aug. 1919, dftsman with irrigation br., Dept. of Int., Calgary; May to Sept. 1920, instrumentman with irrig. br., Dept. of Int., Calgary; May to Sept. 1921 and 1922, rodman with lands surveys dept., C.N.R., Winnipeg; June, July and Aug. 1924 and 1925, detailer with Am. Bridge Co., Ambridge, Penn.; during university sessions, since Oct. 1st, 1922, lecturer in civil engrg., Univ. of Alta., Edmonton.

References: R. S. L. Wilson, A. W. Haddow, R. W. Boyle, E. Stansfield, C. E. Webb, H. J. Gibb, C. A. Robb.

WIGGS—GORDON LORNE, of Quebec, Que., Born at Quebec, Que., July 1st, 1898; Educ., B.Sc., McGill Univ., May 12th, 1921; 1920, 4 mos. with Shawinigan Water & Power Co. on mtce. of transmission lines; 4 mos. on test with Can. Crocker Wheeler Co.; 1921, 4 mos. on test floor with Can. Westinghouse Co., Hamilton, Ont.; 6 mos. salesman with Can. Crocker Wheeler Co.; 1922-23, sales engr. with Mechanics' Supply Co. Ltd., Quebec, Que.; 1923, 3 mos. doing heating design work with C. A. Dunham Co., Chicago, Ill.; 1924 to date, mgr. of engrg. dept., Mechanics' Supply Co. Ltd., Quebec, i/c designs, plan work, etc.

References: A. R. Decary, W. G. Mitchell, L. Beaudry, C. V. Christie, W. F. McLaren, J. R. Dunbar, C. R. Reid, A. A. MacDiarmid.

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The Expansion of Portland Cement Mortar Bars During Disintegration in Sulphate Solutions*

A Report of Special Research Undertaken by the Institute's Committee on the Deterioration of Concrete in Alkali Soils

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It is well known that cement mortar and concrete possess the property of expanding on immersion in water and contracting on drying, and that this property is not lost even after the material has attained great age. Measurements of the absorption of water and the extent of the expansion or contraction of mortar and concrete specimens, when exposed for long intervals to water or dry air, have been made by several experimenters.† It has been found that the expansion on wetting takes place more rapidly than the contraction on drying, and that with increasing age of the test specimens both processes take place more slowly. On continued exposure to water or dry air the expansion or contraction is greatest at first and falls off rapidly to a small value, the volume, in case of all except the richer mixes, becoming soon practically constant. In the case of specimens made of neat cement the change in volume, especially on drying, continues for a score of years. The study of these volume changes has led White to the conclusion that, "alternate expansion and contraction due to changes in moisture is the greatest underlying cause of the destruction of concrete structures."

It seems reasonably certain that we are dealing here with the balance between the expansive forces, in water, of the gelatinous hydration products present in set cement, comparable to the imbibition pressure of a colloid gel, and the cohesive forces of the material. It may, however, be mentioned that H. Nitzche ‡, finding that sandstone also shows swelling and contraction when wetted and dried, the volume changes being greater the denser the sandstone, emphasizes the role that the aggregate plays in the volume changes of concrete. The part that the aggregate plays seems, however, to be a minor one, as rich mortars possess this property in a greater degree than lean mortars while neat cement possesses it in a still higher degree. Further, sandstone is composed of grains of sand cemented together by a foreign material and is thus analogous to a sand mortar, the denser sandstones being comparable to the richer mortars. Matsumoto also found that although dry limestone absorbed water to a greater extent than a 1 to 2 to 4 concrete, it showed practically no expansion and did not contract to a measurable extent on drying.

It is well known that mortar and concrete specimens made from Portland cement expand during disintegration by sulphate waters. This has generally been attributed to expansive forces due to crystallization of gypsum and hydrated calcium sulphoaluminate in the specimen and has been considered by many the real cause of failure of concrete in such waters. Without attempting to determine the cause, this paper gives some of the results of a study of this expansion with a view to using it as a measure, on the one hand, of the disintegrating action of sulphate solutions and, on the other hand, of the resistance of various samples of cement to sulphate action.

Physical Tests on Cements Used **

Laboratory No.	555	8425
Passing No. 200 mesh sieve	84.4%	87.2%
Normal consistency	22.5%	22.5%
Soundness in steam	O.K.	O.K.
Time of Setting (Gillmore)		
Initial	2 hrs. 45 min.	3 hrs. 45 min.
Final	6 " 30 "	6 " 10 "
Tensile strength 1 to 3 briquets standard sand mortar, pounds per square inch.		
7 day	230	219
28 day	335	347

* This work was done under the auspices of a research committee of the Engineering Institute of Canada with the financial support of the National Research Council (Canada), the Canada Cement Company, the Canadian Pacific Railway and the three Prairie Provinces of Canada.

† Matsumoto, Bull. 126, Eng. Exp. Station, University of Illinois; Eng. and Contracting, March 22nd, 1922. Alfred H. White, Concrete 26, 157-161, (1925).

‡ Tonind. Ztg. 40, 357-8, (1916); C.A. 11, 2033, (1917).

** These tests were made by the Department of Civil Engineering, University of Saskatchewan, and supplied by Prof. G. M. Williams.

Chemical Analysis of Cements Used

No.	555	8425
Loss on ignition	2.10	1.32
Silica (SiO_2)	20.55	23.10
Alumina (Al_2O_3)	6.85	6.34
Ferric oxide (Fe_2O_3)	2.65	2.10
Lime (CaO)	61.95	63.33
Magnesia (MgO)	3.52	2.39
Sulphuric anhydride (SO_3)	1.74	1.55

Experimental Procedure

The specimens used in the expansion experiments were mortar bars made of Portland cement and standard Ottawa sand, (20-30 mesh). Distilled water was used for the gauging. The proportion of the mixing water was at first fixed so as to give a flowability of the mix as nearly as possible the same as that used in the preparation of standard sand briquets. This introduced difficulties when dealing with very lean mixes of mortar so that later the standard quantity of water used for a 1 to 3 mix was also used for all leaner mixes. The proportions of cement to sand were determined by weight and the water by volume at 21°C. After mixing the cement and sand thoroughly the water was added and the whole mass well worked to ensure uniformity. The specimens were then moulded in collapsible steel frames so as to give bars measuring ⅝ by ⅝ by 7½ inches. When the moulds were being filled the tamping and trowelling were done as uniformly as possible so as to obtain uniform specimens. The charged frames were stored in a damp closet until the bars were strong enough to be removed, the time required varying with the richness of mortar. The bars were then cured in a damp closet, at least to the end of the twenty-eight-day period, unless otherwise stated.

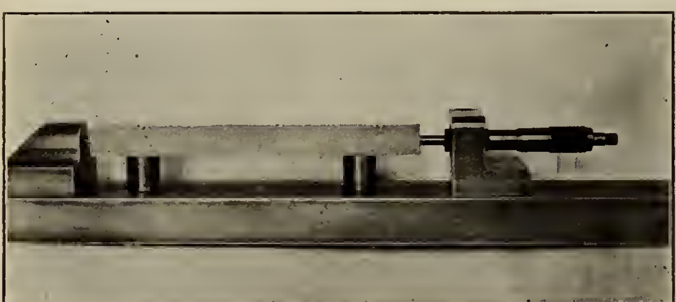

Figure No. 1.

The mortar briquets used for the corresponding tensile strength determinations were made up according to the standard specifications for Portland cement, the mix and the storage treatment being the same as that for the corresponding mortar bars. The determinations of tensile strength were made on a Riehlé machine adjusted to require one-half minute for developing a tension of 300 pounds per square inch.

Considerable difficulty was experienced in obtaining bars with ends suitable for accurate measurement of length. The ends must be smooth, free from easily detachable material and more resistant to the action of sulphates than the bar itself. After considerable experimentation the method finally adopted was to make the bars with a thin layer of neat cement on each end. This gave a suitable surface and reproducible measurements of length could be made.

The mortar bars were found to be well suited for the study of the action of sulphate solutions. They have sufficient strength for handling provided the mortar is not too lean. They allow very rapid penetration of solutions throughout the whole mass and their length is sufficient for the measurement of slight expansion.

Measurements of the length of the bars were made by means of a micrometer head, graduated to read to one-ten-thousandth of an inch, set in a frame made of tool steel (see figure No. 1). A series of measurements on a well made bar was found to fall usually within extremes of 0.0005 inch while the mean of several readings under similar conditions is reproducible at least to within 0.0002 inch.

The thermal expansion of the measuring device was determined between 20°C. and 35°C. and found to be 0.00009 inch per degree. The thermal expansion of wet mortar bars 7½ inches long, for the same temperature range, was found to be as follows:—

Mixture of Mortar	Expansion per °C. for bars 7½ inches long	Coefficient of expansion
1 cement to 2½ sand	55×10^{-6} inches	74×10^{-7} inches
1 " " 5 "	57×10^{-6} "	76×10^{-7} "
1 " " 7½ "	62×10^{-6} "	82×10^{-7} "

It will be seen that provided the bar and the micrometer are at the same temperature small changes in room temperature introduce no appreciable error. A change of 6°C. from the mean temperature of the room would produce a variation of 0.0002 inch in the apparent length of a 7½-inch, 1 to 5 mortar bar. The lag in expansion and contraction during rapid changes of temperature was found to introduce a much greater error. As is to be expected the lag is much more marked for the bars than for the metallic measuring device, and in the case of the bars especially, the lag is much greater during contraction than during expansion.

Exposure of the Bars to the Solutions

After the initial measurement at the end of the curing period the bars were placed in wide-mouthed stoppered glass jars containing the salt solution and measured at frequent intervals until disintegration made further measurements impossible. Three or four bars were generally used in each experiment and the average increase in length taken. In some experiments the bars were first measured damp at the end of the curing period and then dried in a current of carbon dioxide free air at 35°C. before they were immersed in the salt solutions. At first the sealed jars containing the bars and the salt solutions, were immersed in a water thermostat at 25°C. This method entailed so much labour when a large number of bars were being measured that it was abandoned and the bottles were left standing in the laboratory. This does not introduce errors into comparisons within series of experiments started at the same time, but, as the laboratory room varied a good deal in temperature, especially at different seasons of the year, it made difficult the comparison of the results of series carried out at different times. Later a thermostated room was used with a temperature variation of less than 1°C. from a mean value, and finally a room which varied only by about 0.2°C. from the mean.

In plotting the curves for the expansion or contraction of bars the initial measurement of the moist bars after the curing period is taken as the initial or zero point, contractions being expressed as negative and expansions as positive quantities. The expansion, (or contraction), is always expressed in 10^{-4} inches and is always given as the total expansion for a 7½-inch bar. The expansion per inch can therefore always be obtained from the curves by dividing the value for the y-axis at any point on the curve by 7.5, and the percentage expansion, by dividing the value so obtained by 100.

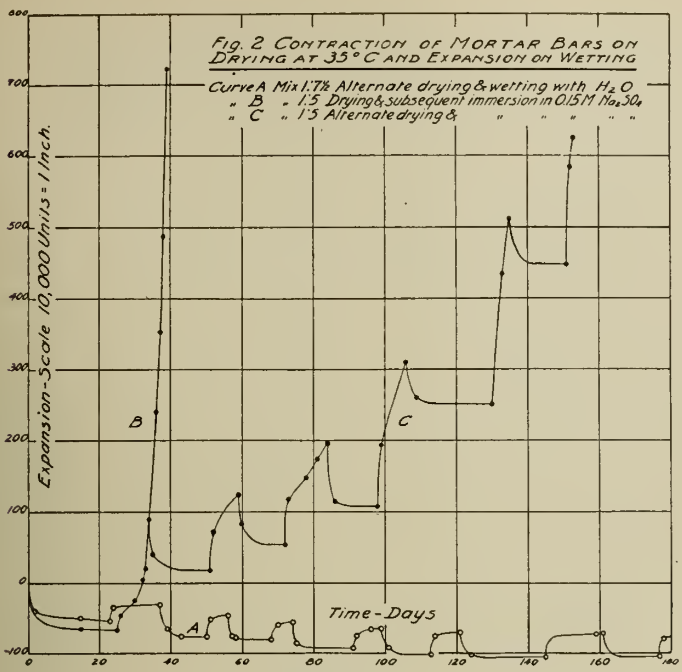

Figure No. 2.

pansion of the bars. Experiments showed that while bars of mixes approaching neat cement require a very long time to attain constant length, a few days' immersion is sufficient to attain very nearly constant length in the case of 1 to 7½ and 1 to 5 mortar bars. Thus the expansion of 1 to 5 mortar bars in five days and in two hundred and fifty days agreed within two ten-thousandths of an inch.

But while exposure of the dried, lean mortar bars to water for long periods produces very little change in length after the first few days, there is evidence of other changes taking place in the bar during the long period of wetting. This was shown by a group of bars which after having been repeatedly dried and wetted were left in water for two hundred and fifty days. After this long period of wetting their behaviour on drying and wetting was similar to that of freshly prepared bars. The curve for alternate drying and wetting was approximately a duplicate of the curve obtained during the initial period of treatment with the difference that the actual length of the bars was somewhat shorter.

These experiments, while of a preliminary nature, suggest that at least one of the colloid components of hydrated cement is rendered irreversible by drying at 35°C. while other colloid components dehydrate but remain reversible when dried at that temperature. The reappearance of the first mentioned type of colloid on long exposure to water may be due to further hydration of the unhydrated kernels of cement in the mortar.

When the wetting liquid contains sulphates the bars behave approximately the same way as in pure water for the first day or two. Then the rate of expansion gradually increases again until finally the bar loses its strength and falls to pieces. Curve B (figure No. 2) gives the expansion during the first fourteen days of immersion for 1 to 5 mortar bars in 0.15 molar solution sodium sulphate. The initial length of the damp bars after one month's curing in the damp closet is taken as the zero point. The bars were dried in a current of carbon dioxide free air at 35°C. for 25 days before being immersed in the sulphate solution.

The expansion of the bars may be stopped anywhere short of complete disintegration by drying them when a slight contraction, comparable to that of bars wetted in distilled water, takes place. Curve C (figure No. 2) gives the result when 1 to 5 mortar bars are alternately immersed in a 0.15 molar solution of sodium sulphate and dried at 35°C. in a current of carbon dioxide free air. The expansions and contractions are not equivalent, the bars increasing permanently in length at each immersion in the sulphate solution until they finally fall to pieces. Almost an identical curve was obtained for bars similarly treated in a 0.14 molar solution of magnesium sulphate.

Comparison of the Expansion of Mortar Bars in Water and in Sulphate Solutions

When Portland cement mortar bars, after curing for some time in the damp closet, are alternately dried in air free from carbon dioxide and wetted in distilled water the changes which take place appear approximately reversible, the contractions and expansions apparently nearly balancing one another except for a rather striking decrease in length on the initial drying which is only partly regained on wetting the bars. Curve A, (figure No. 2), gives the results of such an experiment carried on for a considerable length of time with 1 to 7½ Portland cement standard sand mortar bars which had been cured for thirty-five days in the damp closet before the initial drying. The drying was effected at 35°C. in a current of carbon dioxide free air and measurements were made at intervals until a constant length was attained. The bars were then placed in distilled water at room temperature and the measurements repeated until the length was constant. The portions of the curve with increasing values for the ordinates represent periods of wetting while the portions with decreasing ordinates represent periods of drying.

It will be seen from the curve that the original wet length of the bars is never attained by later immersions in water and that each successive drying and wetting of the bars produces a decrease in length, while the wet length approaches a constant value. Similarly the dry length of the bars decreases at each treatment and finally approaches a constant value. The changes are therefore not wholly reversible. Or one might state the result in a different way. The loss in length of the bars on drying is at first markedly greater than the gain in length on wetting, but on continued treatment the two quantities approach the same value.

A similar curve was obtained for 1 to 5 mortar bars, the numerical value of the contractions and expansions being larger than for 1 to 7½ mix. Richer mixes require very long periods of wetting and drying to attain constancy. Experiments with these were therefore not carried very far but several treatments of 1 to 2 mortar bars gave a similar curve.

The question might arise whether the time of immersion in water was long enough to give the maximum ex-

Expansion of Mortar Bars and Decrease in the Tensile Strenth of Mortar Briquets during Sulphate Action

The only quantitative method available for studying the action of sulphates on mortars is to determine the loss in strength of test pieces at various times during a period of exposure. The usual procedure is to immerse standard briquets or other test pieces in the salt solutions and to determine the tensile or compressive strength at intervals.

A very careful comparison was made of the expansion of mortar bars such as described above and the change in tensile strength of briquets in a 0.15 molar solution of sodium sulphate. A large number of briquets and a few bars were prepared using one part of cement No. 8425, five parts of standard sand and 10.25 per cent of water. After curing in the damp closet for seven days they were immersed in the sulphate solution contained in air-tight glass jars. The ratio of weight of mortar specimens to volume of the solution was about 300 grams to 1700 cubic centimetres of solution. The mean expansion of the bars was determined from time to time as well as the average tensile strength of the four briquets. The values for the tensile strength of the individual briquets were found to be somewhat erratic, especially during the latter part of the exposure to the sulphate solution, an occasional briquet losing strength much more quickly or slowly than the average. The tensile strength of some of the briquets immersed in distilled water was also determined from time to time.

In an attempt to make all the determinations of tensile strengths of the briquets comparable, the first break was made after the briquets had been kept in water for one day. When 1 to 5 standard sand briquets after curing in the damp closet for one week are placed in water they decrease in tensile strength by about 40 pounds per square inch during the first day as compared with a break made with the damp briquets. In a few days the briquets exposed to water regain this strength and soon exceed the original value.

Similar comparisons, using fewer briquets, were made with a 0.5 molar solution of sodium sulphate and 0.15 molar and 0.5 molar solutions of magnesium sulphate.

It is, of course, not fair to make a strict comparison between the two kinds of test pieces as the bars have only a cross-section of 5/8 by 5/8 inch, while the briquets have a cross-section of 1 x 1 inch at the narrowest part. But as 1 to 5 standard sand mortar is very permeable to water there is only very slight difference between the rates of disintegration of the two kinds of test pieces, some of the bars being too weak to handle by the twenty-ninth day, while after the thirty-seventh day most of the briquets became too weak to obtain tensile strengths.

A comparison of the curves, (figure No. 3), indicates several interesting facts. The briquets immersed in the sulphate solution increase at first in strength and this increase is more rapid than in the case of briquets stored in distilled water. After the sixth day there is a sudden rapid decrease in strength, the decrease in one day bringing the strength below that of the water stored briquets and this decrease in strength continues at a gradually decreasing rate until the curve becomes fairly flat as it approaches

Figure No. 3.

very low strengths, while the briquets stored in water continue to increase in strength. The experiments with briquets in 0.5 molar solution of sodium sulphate, also in 0.15 and 0.5 molar solutions of magnesium sulphate, gave similar curves, the increase in strength of the briquets over those stored in distilled water being marked in each case during the first few days. One of us* has already pointed out that presence of sodium sulphate in water with which powdered Portland cement is shaken speeds up the liberation of lime, which normally takes place on hydration of the cement. Also, that the presence of sulphates shifts the equilibrium attained on hydration of cement so that more lime is liberated. The explanation of the abnormal increase in strength of briquets immersed in sulphate solutions may be that this increase in the rate of liberation of lime represents an actual speeding up of normal hydration. It is, however, evident from the curve that further changes which cause rapid decrease in strength soon take place. It is possible that the shifting in the hydration equilibrium causes decomposition of the strength-conferring products of hydration with the formation of substances devoid of cementing properties.

Microscopic examination of the briquets exposed to the sulphate solutions did not indicate any change in the crystalline matter which would satisfactorily explain the shape of the curve. Crystals of sulphoaluminate were found in the briquets immersed in 0.15 and 0.50 molar sodium sulphate after the first day's exposure. These persisted and gradually increased in size. Gypsum crystals soon appeared in the briquets immersed in the more concentrated solution and a little later in those in the dilute solution but were never very numerous in the latter. Gypsum appeared almost immediately in the briquets exposed to the two solutions of magnesium sulphate and the crystals continued to grow in size as the action progressed. These observations are in general agreement with the results of shaking powdered cement with the corresponding sulphate solutions.† Apparently the microscopic data gives no clue as to the cause of the sudden change in the tensile strength of the briquets about the seventh day (in the 0.15 molar sodium sulphate) and one is therefore led to believe that the reason is to be sought in chemical changes taking place in the amorphous or colloid mass.

The curve for the expansion of the bars does not give any indication of the initial increase in strength. From a large number of experiments there is, during this period, some indication of contraction of the mortar specimens, this effect being masked by the expansion due to wetting and appearing in general only on the second or third day. Except for this, there is a gradual very slight expansion until the sixth or seventh day when the curve is definitely inflected upwards and finally the rate of expansion becomes almost constant until the bars become too weak to handle. The point of inflection occurs at the same time as the sharp turn downwards of the tensile strength curve for the briquets and the two seem therefore to be due to a common cause. Bars immersed in distilled water show a very similar expansion as those in sulphate solution during the first day, then expand very slowly until practically constant in length. This requires usually about one week for lean mixes, (1 to 7½ and 1 to 5). Thus while there is no evident relation between the curves for the expansion of bars and the increase in strength of briquets exposed to distilled water, there is a very marked relation (after the initial period of increase in strength) between the tensile strength curve for mortar briquets and the expansion curve

* G. R. Shelton, Ind. & Eng. Chem., 18, 854, (1926).

† G. R. Shelton, Ind. & Eng. Chem., 18, 854, (1926).

467, (1925).

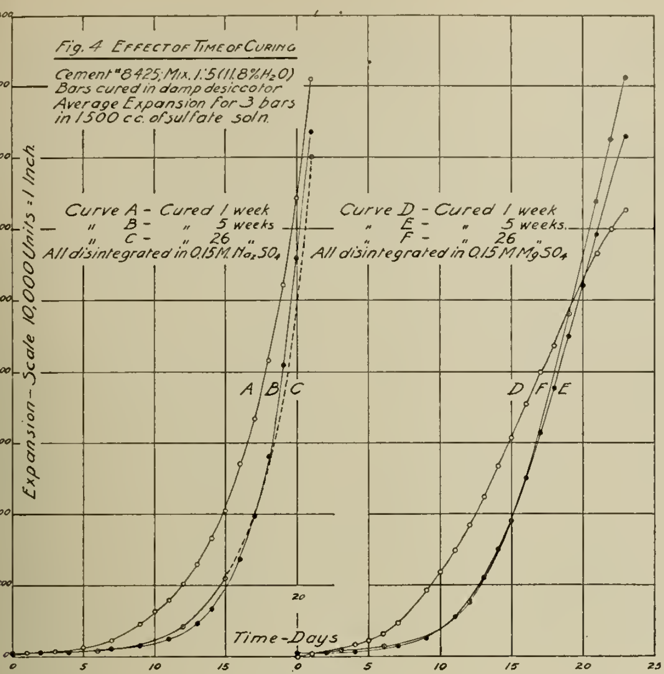

Figure No. 4.

of mortar bars of the same mix exposed to sulphate solutions.

While it would be possible to predict the value for the tensile strength of a mortar specimen from its expansion it is evident that the two curves have marked differences apart from the early increase in strength. The expansion is very gradual during the early stages and later the rate increases to an almost constant maximum value, while the loss in strength, after the sixth day, is at first very rapid and later slows down materially. The expansion curve is what one would expect from consideration of the tensile strength curve, if one assumes that the expansive force is constant, or nearly so, while the cohesive force, of which tensile strength is a measure, decreases rapidly at first and then more and more slowly.

A similar comparison of the expansion of mortar bars and the loss in tensile strength of mortar briquets in 0.16 molar solution of sodium sulphate was made, using cement No. 555, mix 1 to 5. The test pieces were cured in the damp closet for three months before being immersed in the sulphate solution. The tensile strength of these briquets, (average of 8 briquets), at the time of exposure to the sulphate solution was found to be 201 pounds per square inch, and this increased, on two days' immersion, to 218 pounds, while on the third day and thereafter there were losses in tensile strength. The tensile strength curve obtained was similar to that obtained from the corresponding mix of cement No. 8425, cured seven days, (figure No. 3), except that the period of increase in strength was shorter, (two days against six days), the increase in strength more rapid but not so great, (17 pounds per square inch in two days against 26 pounds in six days), and the loss in strength not so rapid during the first few days after the deflection of the curve downward. The total time of disintegration of the test pieces was not lengthened. The effect of storage on the expansion of bars is to produce corresponding changes, (i.e., slower rate of expansion during the early stages, without changing markedly the total expansion at time of disintegration) as may be seen by examining the curves of figure No. 4.

In considering the admissibility of the expansion method as an independent method for determining sulphate action, it should be remembered that failures of concrete structures exposed to "alkali" occur usually through buckling caused by expansion, long before the strength of the material is reduced to the point where there would be any danger to the structure were the expansion due to the action of sulphates absent. The expansion is thus one of the principal factors causing the failure. Although it appears that there is a definite relation between the curves for loss in tensile strength and expansion, it is possible that a thorough testing of the sulphate resistance of a cement should include a determination of both of these curves, or still better, the determination of the expansion curve and the curve for compressive strengths. The expansion method has been used in this laboratory mainly for experiments with cement mortars, but should be applicable to concrete, especially the leaner mixes.

The authors have used this method of measuring the expansion of mortar bars for following the effect of sulphate solutions on cement mortars since the summer of 1922 with a great deal of saving of time, energy and material, as compared with using briquets and determining loss in tensile strength. An expansion curve, such as the one given in figure No. 3, may be obtained by measuring about a dozen times three or four test pieces immersed in one and a half liters of solution. The tensile strength curve corresponding to it was obtained by the use of more than six dozen briquets and more than fifty liters of solution. It is also the experience of the authors that much more concordant and reproducible results can be obtained by the use of the expansion method. The values obtained for the tensile strength of a mortar using the so-called "standard" briquets carefully prepared and stored in water vary at times considerably, while these variations seem to be magnified when the briquets are exposed to disintegrating solutions. Thus the breaking strength of two briquets prepared and treated in the same way often varies by several hundred per cent during the later stages of sulphate action. Large differences in the rate of expansion of well made bars of the same batch are rare, and if a bar is exceptional the whole curve for its expansion is available instead of a single tensile strength of the briquet at one point on the curve.

It is evident that the expansion method for studying sulphate action has very marked advantages when the

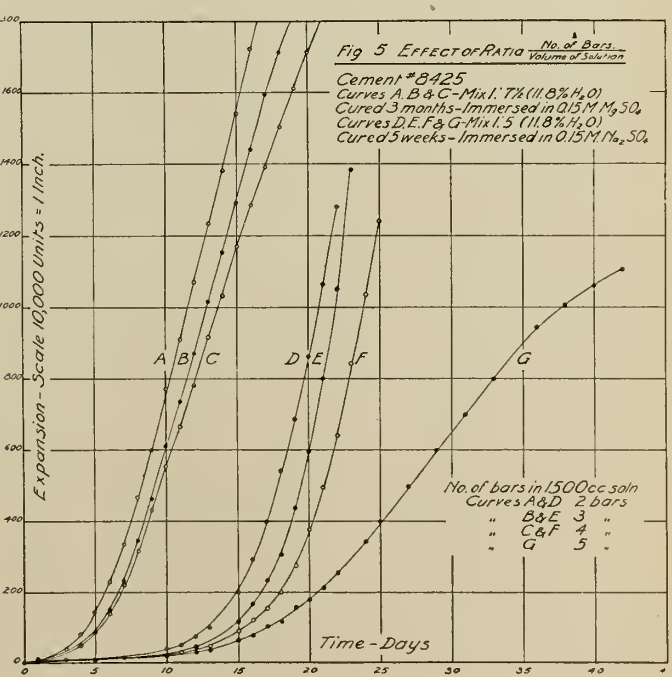

Figure No. 5.

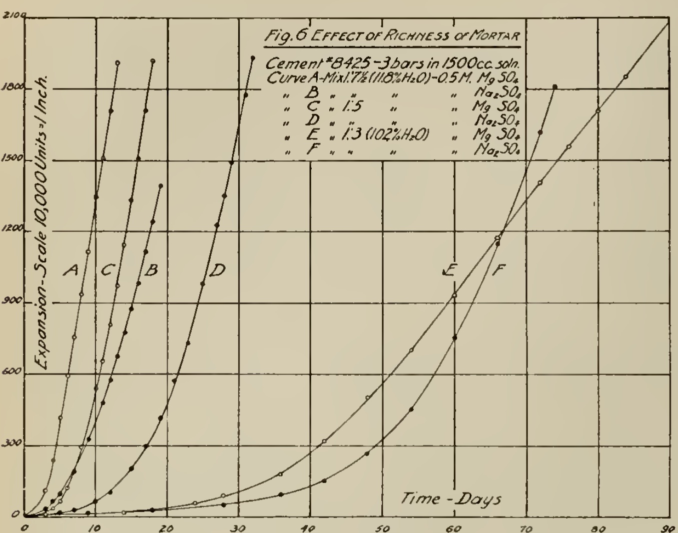

Figure No. 6.

action progresses very slowly and the series of experiments last for months or years. Only a few test pieces are necessary and these last throughout the experiment, while it is difficult to predict at the beginning of an experiment how many briquets are necessary as many are apt to be wasted on making unnecessary breaks. By measuring a few bars occasionally one can follow the progress of the action and make quantitative comparisons long before there is any visible effect of the action on any of the test pieces.

Effect of Time of Curing on Expansion in Solutions of Sodium and Magnesium Sulphate

This was determined for 1 to 5 mortar bars in a 0.15 molar solution of sodium sulphate and a 0.15 molar solution of magnesium sulphate. The bars were placed in a sealed damp desiccator as soon as they were removed from the steel frames so as to prevent absorption of carbon dioxide during the long period of curing. At the end of one week, five weeks and twenty-six weeks respectively, three bars were distintegrated in 1,500 cubic centimetres of each of the solutions. The curves (figure No. 4) show that there is a marked difference between the expansion curves for the week old and the five weeks old bars, the expansion of the latter being much slower during the early stages but later increasing more rapidly and in three weeks nearly equalling, in the case of sodium sulphate and surpassing, in the case of magnesium sulphate, the expansion of the one week old bars. There is very little change in the curves for further twenty weeks' curing except that the latter portion of the curve for the expansion in magnesium sulphate is slightly steeper.

These and other experiments indicate that although the time of curing is an important factor affecting expansion of mortar bars in sulphate solutions, comparisons of bars cured the same length of time, whether for one week or more, give similar results, and that after one month the effect of time of curing is very slight.

Effect of Variation in the Number of Bars Immersed in a Fixed Volume of Sulphate Solution on the Expansion of Mortar Bars

Figure No. 5 gives the results of experiments on the effect of variation in this ratio on the expansion of 1 to 5 mortar bars in a 0.15 molar solution of sodium sulphate and of 1 to 7½ mortar bars, in a 0.15 molar solution of magnesium sulphate. The curves were all obtained from experiments carried on concurrently and are therefore comparable although the room temperature varied somewhat.

Curves D, E, F, and G show that the expansion of 1 to 5 mortar bars in 0.15 molar sodium sulphate is retarded as the number of bars, immersed in a fixed volume of solution, increases. This retardation in the expansion from D, where two bars are immersed in 1,500 cubic centimetres of solution, to F, where four bars are used for the same volume of solution, is fairly uniform and amounts practically to a shifting of the curves from left to right. When five bars are immersed in the same volume, (curve G), there is a marked flattening of the curve and in addition a falling off in the rate of expansion after this has reached about 0.08 inch for the 7½-inch bars (a little over one per cent expansion). This is no doubt at least partly due to the decrease in the concentration of the sulphate in the solution due to formation of calcium sulphate as the action proceeds. In corresponding experiments with a 0.50 molar solution of sodium sulphate the four curves are all similar, the gradual shifting to the right with increase in the number of bars in 1,500 cubic centimetres of the solution, appearing as above while the curve for five bars in 1,500 cubic centimetres of solution does not differ in any other respect.

Curves A, B and C indicate the effect of variation of the same ratio on the expansion of 1 to 7½ mortar bars immersed in a 0.15 molar solution of magnesium sulphate. These curves show retardation to a somewhat smaller degree. The curves obtained from experiments with 1 to 5 mortar bars in 0.15 and 0.50 molar solutions of magnesium sulphate were similar to the curves obtained with the corresponding solutions of sodium sulphate except that the one for five bars in 1,500 cubic centimetres of the 0.15 molar solution showed no variation similar to that of curve G.

The weight of the 1 to 5 mortar bars used in the above experiments averaged about 100 grams each, while the 1 to 7½ bars averaged about 95 grams each.

It is evident from these experiments that comparisons of the expansion of mortar bars in sulphate solutions are not permissible when the ratio of amount of mortar to volume of solution varies.

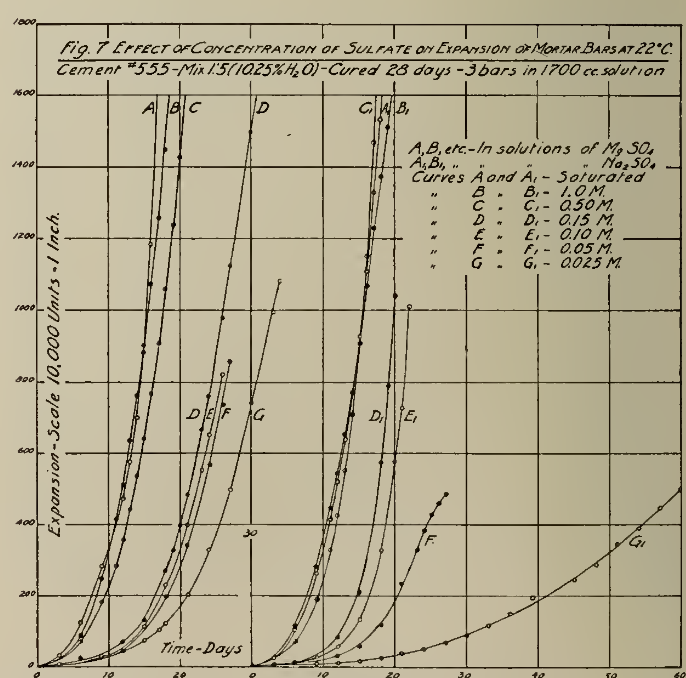

Figure No. 7.

Effect of Richness of Mortar on Expansion of Mortar Bars in Solutions of Sodium and Magnesium Sulphates

Expansion curves were determined for three different mixes of cement No. 8425, namely 1 to 7½, 1 to 5 and 1 to 3 standard sand mortar bars, in 0.15 and 0.50 molar solutions of both sodium sulphate and magnesium sulphate. The curves obtained with the 0.50 molar solutions are given in figure No. 6.

Curves A, C and E give the expansion for 1 to 7½, 1 to 5 and 1 to 3 mortar respectively, in a 0.50 molar solution of magnesium sulphate, while curves B, D and F represent the corresponding ones for a 0.50 molar solution of sodium sulphate. It is seen that the effect of richness of mix is somewhat greater in the case of solutions of magnesium sulphate, the difference between the number of days required for equivalent expansion of the 1 to 5 and 1 to 3 bars, being greater than in the case of sodium sulphate. The curves for the 1 to 3 mortar are not as steep as those for the leaner mixes and this effect is more marked in the magnesium sulphate solution. This may be due to decrease in permeability of the bars by the precipitation of magnesium hydroxide in the pores of the mortar.

It should be mentioned that the lower amount of mixing water used for the 1 to 3 bars prevents a strict comparison with the 1 to 5 and 1 to 7½ bars. If the two leaner mixes had been made with 10.25 per cent of water the result would have been a shifting of the curves to the right and therefore a decrease in the difference between the rate of expansion of these and the 1 to 3 bars.

The curves for the three mixes in 0.15 molar solutions of the two salts present a very similar picture. The rate of expansion of the two leaner mixes in the more dilute solution does not differ very much while the rate for the 1 to 3 mortar bars is markedly slower. As with the higher concentration the expansion of the 1 to 3 bars is at first more rapid in the magnesium sulphate solution, while later the relative rates are reversed, the two curves intersecting at an expansion of about 1,200 units (0.12 inch for a 7½-inch bar or 1.6 per cent expansion). The time required for this expansion in the 0.15 molar solution is ninety-seven days against sixty-seven days for the 0.5 molar solution.

Effect of Concentration of Sulphate Solutions on the Expansion of Mortar Bars

The curves of figure No. 7 indicate the effect of the concentration of solutions of sodium and magnesium sulphate on the expansion of 1 to 5 Portland cement mortar bars. The bars were made from cement No. 555 using 10.25 per cent of water and were cured for twenty-eight days in the damp closet. The temperature at which the comparison was made was 22°C. and the concentrations of the solutions were in each case saturated, 1.0, 0.5, 0.15, 0.1, 0.05, and 0.025 molar. Three bars were disintegrated in 1,700 cubic centimetres of the solutions.

The curves make possible not only a comparison of the expansion of bars in the various concentrations of each salt but also between corresponding concentrations of the two salts. For solutions of both salts the effect of concentration above molar is almost negligible and between molar and 0.5 molar very slight. For solutions of lower concentration the effect is more marked, and below 0.05 molar, the slowing down of the rate of expansion is especially marked in solutions of sodium sulphate.

The expansion in saturated solutions of the two salts is nearly identical. The same applies to 1.0 molar solutions, the bars in sodium sulphate expanding at first a little more rapidly and later a little more slowly than those in magnesium sulphate. Below this concentration there is a marked difference in the character of the curves for solutions of the two salts. The curves for magnesium sulphate have all approximately the same inclination, the curves becoming slightly less steep as the concentration decreases, while the curves for 0.5, 0.15 and 0.1 molar solutions of sodium sulphate become, after expansions to above 200 units, progressively steeper. On the other hand the curves for 0.05 and 0.025 molar sodium sulphate do not show this speeding up, the rate of expansion falls off and the bars fall to pieces before they have expanded 0.7 per cent of their length. A series using 1 to 7½ mortar bars of the same cement in solutions of sodium sulphate showed the same effects to a marked degree.

For solutions of magnesium sulphate the time required for a given expansion in the most dilute solution (0.025 molar or about 3,000 parts per million) is a little over twice that required to produce the same expansion in a saturated solution (about 26 per cent at 22°C.). This is a small effect for an almost ninety-fold increase in the concentration. In the case of the corresponding solutions of sodium sulphate (0.025 molar or about 3,500 parts per million or 0.35 per cent and saturated at 22°C. or about 18 per cent) the dilute solution requires about five times as much time as the concentrated one for equal expansion. The lower limit of concentration, one which causes 1 to 5 mortar to disintegrate fairly rapidly, is commonly found in the seep-

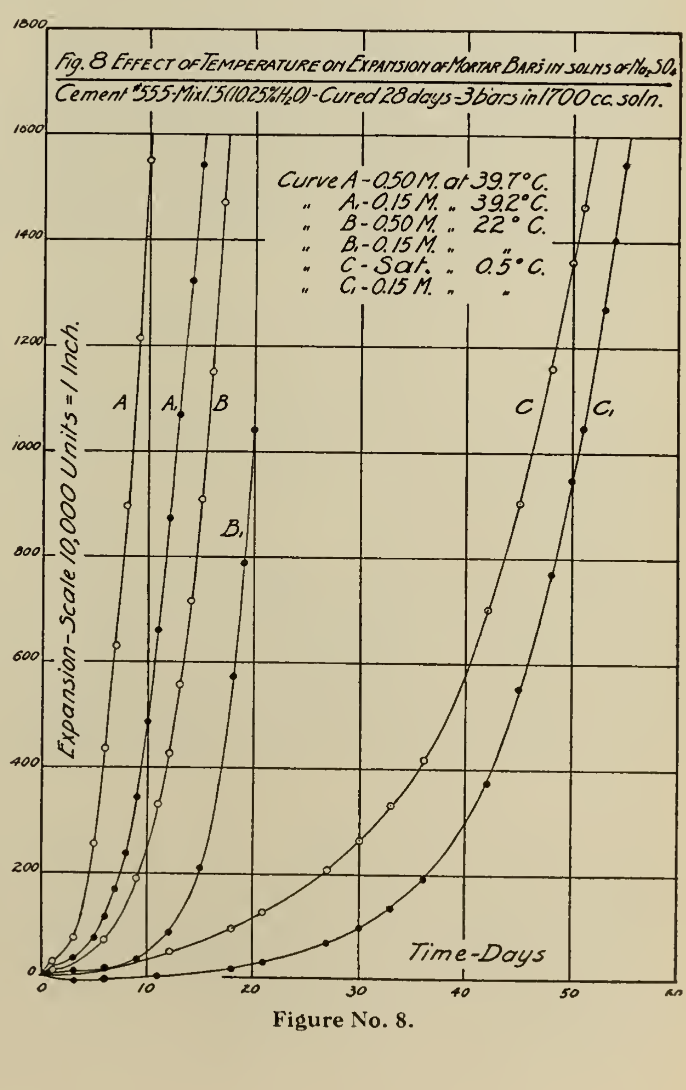

Figure No. 8.

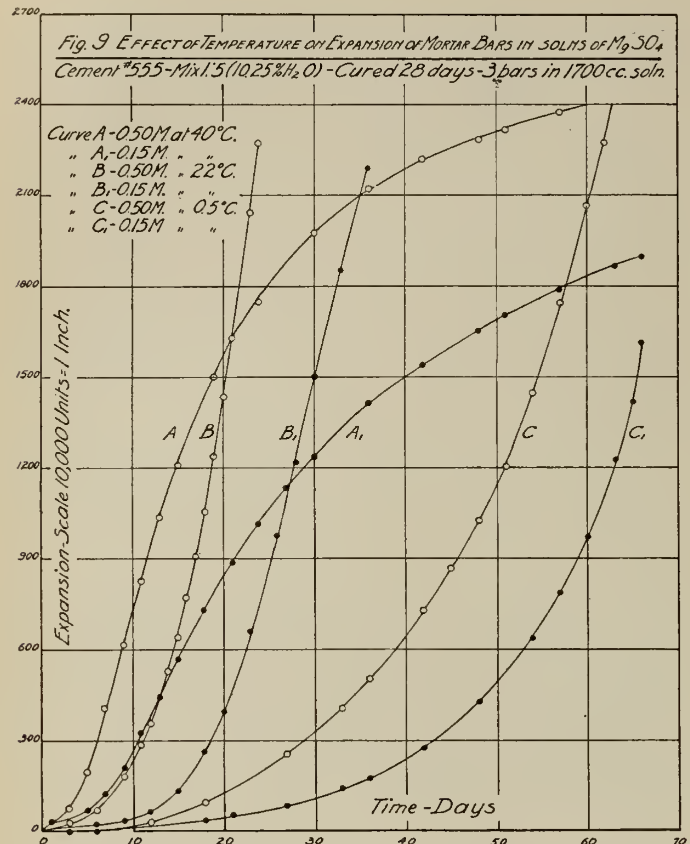

Figure No. 9.

age water in shallow wells on the central prairie even where the soil is not considered to be charged with alkali. It has been shown* that well made concrete may disintegrate when partly immersed in water containing less than 1,000 parts of sulphate per million, a concentration comparable to that of wells from which some cities on the central prairies draw their water supply.

Effect of Temperature on the Expansion of Mortar Bars

Figure No. 8 gives expansion curves for 1 to 5 mortar bars in 0.5 and 0.15 molar solutions of sodium sulphate for temperatures of 0.5°C., 22°C. and approximately 40°C. and figure No. 9 gives the corresponding curves for solutions of magnesium sulphate.

Plotting, from figure No. 8, temperature against time for expansions of 200, 600 and 1,000 units one finds that each increase of 10°C. in the temperature reduces the time necessary for equivalent expansion by about one-third with a slight tendency to a decrease in the reduction as the temperature rises. The speeding up of the action with rise in temperature may be due mainly to the increase in the rate of diffusion within the bars. Experiments with 1 to 7½ mortar bars give a somewhat larger effect for temperature.

The effect of temperature for solutions of magnesium sulphate between 0°C. and 22°C. is somewhat greater. The results with this salt at 40°C. indicate that there is a marked change in the action of the salt on the mortar, the bars expanding rapidly at first and then more slowly without falling to pieces until finally the bars kept at 0.5°C. show a greater expansion than those at 40°C. This effect of solutions of magnesium sulphate, above ordinary room temperature, is being studied further.

* Mackenzie and Thorvaldson: Engineering Journal, Feb. 1926.

The Effect of the Amount of Mixing Water

The percentage of mixing water has a very marked effect on the expansion of mortars in sulphate solutions. Experiments for the purpose of determining this effect accurately must be rigidly controlled since factors such as the degree of humidity of the room in which the specimens are prepared, slight changes in the saturation of the air in the damp closet, (such as may be brought about by slight fluctuations in temperature), the time of curing and other minor factors have a very marked effect on the results. As the matter is rather complicated, the experiments dealing with it will be discussed in a later paper.

Comparison of Cements Numbers 8425 and 555

Minute comparisons between the curves of the various figures given above can be made only with a good deal of caution since factors such as percentage of mixing water and time of curing often vary. Even when these are the same there may be differences due to variation in humidity conditions at time of preparing the specimens or in the temperature of the damp closet during storage. There is, however, a marked difference in the behaviour of the two cements, which may be seen from comparison of the curves.

From figure No. 7 we see that the expansion of 1 to 5 mortar bars of cement No. 555 is somewhat more rapid in solutions of sodium sulphate of medium concentration (0.5, 0.15 and 0.1 molar) than in solutions of magnesium sulphate of the corresponding concentrations. The curves of figure Nos. 8 and 9 indicate that the same holds for the solutions at other temperatures. On the other hand, from figure No. 4 it is evident that 1 to 5 bars made from cement No. 8425 expand more rapidly in a solution of 0.15 molar magnesium sulphate than in a sodium sulphate solution of the corresponding concentration. This is most marked in the bars cured for more than one week and for expansions below 1,000 units (0.1 inch for a 7½-inch bar or 1.3 per cent). The curves of figure No. 6 indicate that the same relation holds even more markedly in 0.5 molar solutions of the two salts. Thus cement No. 555 appears more resistant to the action of magnesium sulphate than to that of sodium sulphate while for cement No. 8425 the reverse is the case. A comparison made under the same conditions confirmed this conclusion.

Summary

(1) A comparison is made between the contraction and expansion of Portland cement mortar bars when alternately dried and wetted (*a*) in water and (*b*) in sulphate solutions.

(2) A method of measuring the progress of the action of sulphate solutions on cement mortars by determining the expansion of test pieces is described.

(3) This method is compared with the one of following sulphate action by determining at intervals the loss in tensile strength of mortar briquets.

(4) Curves are given which show the effect of various factors such as the time of curing, volume of disintegrating solution, richness of mortar, concentration of the solution and temperature on the expansion of Portland cement mortar bars in solutions of sodium and magnesium sulphate.

(5) Test pieces made from two normal Portland cements are compared as to their relative expansion in solutions of sodium and magnesium sulphate.

Valuation Work from the Engineer's Standpoint

A Brief Outline of General Valuation Work, Emphasizing the Valuation of Buildings, and Dealing with Depreciation

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Paper read before the Toronto Branch of The Engineering Institute of Canada, March 10th, 1927

Most engineers, at one time or another, have had occasion to make valuations, either small or large, of some description of property, buildings, utilities, machinery or equipment, and it is with the intention of calling attention to this somewhat neglected branch of the profession and laying down a few broad general principles in connection with the work that has led to this statement of personal opinions formed in connection with this work over an extended period.

All the published works that the author has read on the subject approach the matter in a very general way, and give very minute instructions and excellent advice as to the methods of preparing and tabulating the items, the importance of photographs, the cost by years over a period, of several given general types of buildings, the findings of judicial bodies in special cases, tables of estimated life of different types of buildings, definitions of depreciation, etc., but all practically agree that the result depends upon the way the expert evidence is presented. It devolves upon the engineer in his evidence to convince a judge, (or arbitrator), that his point of view is reasonable.

Our profession comprises such a wide field that there is no part of any kind of business or plant, the knowledge of which is not covered by courses, either ordinary or special, of the engineer's curriculum, or by practical observation during a varied career.

The case of valuation of stocks of a special kind of merchandise solely involves reference to invoices and common sense as regards depreciation, obsolescence and market facilities.

Valuation of land demands a knowledge of surrounding values, recent sales prices and any special recommendations of location or formation for any special purpose.

In cases of some large structures it is often advisable to get opinions of several engineers, each having expert knowledge of a separate part of the valuation to be made and incorporate them for the complete valuation, but in many cases one man with varied experience can intelligently handle the whole.

The reason for a valuation is generally one of the following seven:—

(1) To check up book values under changing conditions.

(2) For insurance purposes, as basis of claim settlement after visible evidence is destroyed.

(3) For fixing or adjusting rentals.

(4) For assessment purposes or tax adjustment.

(5) When sale of business is intended.

(6) The purposes of company flotation.

(7) In case of expropriation by a governing body.

The Engineer's Attitude

It has been stated by some authority that the amount of a valuation is governed by the purpose for which it is being prepared. This may be the case in the final presentation, after it has left the engineer's hands, but the attitude of the engineer should not be biased by any of the foregoing reasons; he should not be tempted to inflate or deflate his estimates of value to accommodate the purpose for which the valuation is made. His report should impartially describe the defects as well as the advantages of the subject, so that when he submits his finished report the result is a fair, honest and comprehensive representation of the facts as he sees them, without prejudice as to which interest is going to use them. He must be prepared to be interrogated in a court of law on any point or points embodied in the report in the interests of the party for whom he prepared the report and know that his statements would be the same as if he had been engaged and paid by the opposing interest.

It sometimes happens that an expert prepares a report and makes statements of values before a judge for one interest, and within a short time has to do similar work and testify before the same judge for the opposing interests, who are this time in litigation with the group for whom he prepared the last report. It can be easily imagined that any discrepancy in his statements will be seized upon and turned to his discredit, unless there are circumstances that warrant these discrepancies. Of course, we all live and learn, (that is one of our excuses for living, to learn to be of value to the community), and a fixed conviction or pet theory of to-day may be greatly modified or entirely altered to-morrow by some convincing and unanswerable demonstration to the contrary, and we, of necessity and with good grace, are compelled to endorse the changed view and admit our error.

The cases are presented and findings given by members of the legal profession, yet the statistics and data are gathered and estimated by engineers, whose reports form the armament and ammunition for the lawyers, and it is most important to present the facts fully, showing both the good and the bad, so that the legal man can present or reject any features at his discretion, and, in any event, he will have been instructed as to the weak points of his case.

General Valuation Work

Valuation work to the engineer covers a vast field, from a building in a crowded metropolis to a power plant in the heart of a wild country, a mining property as a going concern or a railroad and its vast ramifications.

Of course, these widely varied subjects need the expert services of the electrical, hydraulic, mechanical and mining engineers, with their specialized knowledge of installation, equipment and operation of the different types of industries. The land values, irrespective of the riparian rights for the power plant or the mineral rights of a mining property, are fairly easy to arrive at, being governed by recent sales of similar land and other factors mentioned hereafter, and land is one item that enters into nearly every valuation; but on every developed property there will be buildings of some kind, of diversified type and construction, and although in some cases the value of the buildings upon a property will be but a small percentage of the whole, yet buildings occur in nearly every important valuation, and for this reason most of the space in this paper is being devoted to their consideration.

The following statement, from a work by William Arthur, published in New York, is submitted in its entirety as illustrating one man's views of the varying opinions of different authorities on the same subject in the United States:—

"After the physical valuation of a railroad is made, the work is only well started. A celebrated Frenchman once gave the right rule for doing anything. It ran, ' First of all, define your terms. The cost of a railroad is not its value; reproduction value is an indefinite term; there is or there is not such a thing as depreciation,' and so on, words without end.

" Some believe in public ownership of railroads and other utilities and others do not. Regardless of which is right, it may be safely concluded that few men are doing more for the success of the public ownership theory than the lawyers, who take hold of a physical valuation and make a rubber band of it, stretched long or short to suit the side that hired them. Regulation has failed in some countries and government ownership has come. Those who do not like that should do their best to get everything connected with their particular semi-public utility regulated on a fair basis.

" The Supreme Court of Minnesota considered that the cost of reproduction is practically the only element necessary to be considered by the state in fixing rates; the Supreme Court of the United States declared this to be only one element of several; the Washington State Commission, before determining the market value, ascertained:—

(1) The original cost of construction.
(2) Cost of reproduction new.
(3) The depreciated value.
(4) The amount and market value of outstanding stocks and bonds.
(5) The density of population and traffic.
(6) The nature and permanency of population and traffic.
(7) Facilities for doing business.
(8) The physical conditions under which the road is operated.

This concludes the quotation, and goes to show how widely different are the opinions of three governing judicial bodies on the same subject, and this divergence of opinion occurs in a greater or lesser degree in almost every branch of valuation.

Valuation of Land

In a busy city, this part of a valuation can best be looked after by a local real estate man, and unless the engineer has good local experience in this matter he had better transfer this responsibility to a reputable real estate man, as he has his finger on the pulse of the market, has knowledge of recent and remote sales, is aware of the present demand and maximum values.

In some cities it is the practice for those interested to divide the city into zones of varying radii from some focal point or heart of business section, and to roughly valuate the land within each limit at a fixed price per acre, varying with the distance from this point and whether of industrial or residential character. In some other cities the zones are laid out with reference to railroads, bridges across rivers, etc., and have little reference to any focal point. The results are the same; it is the demand that creates the values, and each successive sale acts as a guide or reference for future sales.

Some cities use the superficial foot as the unit for price comparison, while in other cities the frontage foot is the unit for small lots, but this is misleading unless the depth of lot is mentioned as well, and the price per acre becomes the ultimate comparative unit of cost.

The valuation of land, other than city properties or township lots, can be handled by the engineer in connection with any business project which he is formulating, for undeveloped land may be classified as being in one division of the following general category:—

(1) Farm lands,
(2) Forest lands,
(3) Barren lands,
(4) Marsh lands.

As such, it has a certain recognized value per acre as the minimum price, which by competition can be raised almost indefinitely by reason of any special speculative or proved advantages it may possess, such as mineral, adjacent water power, oil, agricultural, industrial, residential or as right-of-way for railroads, etc., and the estimating of values of such advantages is part of the business of an engineer.

In townsite properties, especially in the planning of such, there is great need for level-headed, far-seeing members of the engineering profession who will function outside th vortex of hectic optimism and almost criminal rapacity of subdivision cranks.

Valuation of Buildings

Before the World War, the practice of valuating a building by multiplying the cubic contents in feet by a unit cost was generally resorted to, and tabulated lists of different types of buildings and their approximate cost per cubic foot were used by some valuators, the lists being adjusted every year to suit market prices of labour and material. But the rise in prices was so rapid and so varied, with the many different materials used, until 1920, (when the peak cost was reached and a slight fall followed in 1921), that the units per cubic foot of cost, which had been adjusted to the varying prices, were found to be most unreliable and it became compulsory to carefully take off the quantities of labour and material of each trade's work of typical buildings and price them at current rates for new records.

This method of pricing the cubical contents is not reliable in any way, unless it is established where the vertical dimensions shall be calculated from. Some authorities use the top of basement floors as their starting point and others the bottoms of the footings of a building, and in the case of expensive foundations such as piling or caissons to rock, the foundations had better be separately calculated in any case, as it is very seldom that we get two buildings that are identical in every respect for our comparison of costs. The method of using a unit cost per square foot of floor of typical buildings gives perhaps a little more accurate results, but both methods are at best very rough and approximate means of arriving at a quick result.

Regarding the above mentioned rapid and uneven rises in prices of materials and labour, in the light of these changes, the best physical valuation that could be made was only good for the month during which it was made, and twelve months afterwards it was obsolete.

Another good reason for taking off quantities of the different trades' work combined in any structure and estimating replacement cost of each separately is the greater accuracy with which the depreciation of the whole can be estimated, as each trade represents a certain value upon which varying mortalities can be placed, and from these the mortality and depreciation of the building as a whole can be determined upon.

Present Value

The more you delve into any published statistics and the more you study the argued cases and findings of different arbitration proceedings in connection with this subject, the more you become convinced that the term " present value," used in connection with buildings or properties, is one of the most elastic in our language, depending upon the clever and intelligent presentation of the case by the experts for and against. In short, it is only a point of view taken by the judge or judges.

In the United States, it seems to be the opinion of the Interstate Commerce Commission, and apparently also of the Supreme Court, that the present value of a building, or even of an entire business, is the replacement cost less depreciation plus a " going concern " value.

This is without doubt correct as regards an entire business, but in any case it is best to keep the " going concern " portion of indemnity apart from the building proper and include it in the goodwill or business value. The author's views of this will be explained at greater length in dealing with depreciation.

After all, the " present value " is the goal at which we are aiming in a valuation, and in the case of a building is it not better to segregate from the structure and value separately all auxiliary matters which contribute to the value of the business as a whole, and thus minimize the chances of disagreement and error by tracking each item to its lair, as it were, and despatching it with a certain agreed value rather than by dealing in generalities and incorporating the structure with the volume of business?

Replacement Value

The practice of asking one or more contractors to make estimates from plans or actual buildings for the purpose of arriving at a fair replacement value is not any better, to my mind, than entrusting a qualified engineer, skilled in this work, to prepare an estimate. In works that have been actually carried out, when the engineer in charge has had reasonable time to prepare a carefully detailed estimate beforehand, we will generally find a very small percentage of difference between his estimate and the accepted tender which has passed through the fire of competition. It is not unusual to find a difference of 30 per cent between the lowest and highest tenders of reputable firms on important construction work, and it is not always easy to discover the cause for this difference. On the other hand, when contractors prepare the estimates for replacement value they know they will not be called upon to carry out the work if their tender is low and they will not lose a valuable contract if their estimate is high, so there is not the inducement to apply the same principles and energy to this kind of estimate as there is in a live issue concerning the erection of a proposed new structure.

Therefore, an engineer with special training and practice in this work is well equipped to give good results.

As the years pass, a structure in itself does not become more valuable, but deteriorates from the day it was built. If we make the statement that a building that cost $50,000 when it was built five years ago is worth $55,000 to-day, we mean that labour and material costs have risen in price and we are regarding the dollar value only.

A false valuation may be the outcome of mistaken ideas, careless valuation or trial figures set down as a basis for bargaining and inflated for that purpose. This is to be deplored and reflects discredit upon the appraiser, especially in the last mentioned case. Some people have the idea that it is quite allowable to inflate or deflate values according to the position of their principals, as vendors or purchasers, expecting that the opposing side will do the same and some happy medium will be struck as the result of tedious bargaining. The person who lends himself to this practice will have to continually change faces, according to the side of the bargain on which he finds himself retained.

In short, replacement value of a building should mean the present-day cost to erect a building of similar or equally good materials in like quantity and similar positions as those in the building under consideration, without reference to change in practice, obsolescence of building or any change in building by-laws which might make it imperative to erect a more expensive structure of different materials. The latter phase is being dealt with separately in another part of the valuation, under the heading of compulsory increased cost of business operation.

Depreciation

In the matter of valuating buildings, we have under the heading of depreciation one of the most debatable and potent factors of the whole valuation, for when the replacement valuation is agreed upon then comes the deduction for depreciation, which, judging by some interpretations, is an El Dorado for legal endeavour.

What is depreciation, as applied to buildings? It is the decrease in value to an owner or owners by reason of:—

(1) Natural decay of its component parts,
(2) Wear and tear,
(3) Obsolescence,
(4) Inadequacy.

Efficiency and depreciation are not synonymous. A plant or structure may be 100 per cent efficient for its present purpose, but the deterioration of its parts may be considerable, and the length of future useful life is the point to be determined, which can best be estimated by the number of years it has already been in service and the estimated life span agreed upon for similar plants or structures.

" Tiffany's Estimate of Depreciation of Buildings," as used by the United States government, is:—

Brick, occupied by owner	—1	to 1¼	per cent of investment per year
" " " tenant	—1¼	" 1½	" " " " " "
Frame, " " owner	—2	" 2½	" " " " " "
" " " tenant	—2½	" 3	" " " " " "

These figures for depreciation include buildings where ordinary maintenance expenses have been expended. If extraordinary repairs or replacements have been made, the discount should not be so heavy.

The practice of quoting abnormal cases of duration of different types of buildings is not sound, since it is the exception that proves the rule, and if a life of eighty years was agreed upon as a fair average life of a particular type of building, the quoting of some extreme case of two hundred years should not affect the average. Canada is a young country and one of increasing land and property values, and it is not the practice to build for more than one hundred years in any case, and in many cases for a lesser period, unless the buildings are of a memorial or public type, which are in a class by themselves and require individual consideration when valuation is necessary.

It is possible by expensive maintenance, repairs and renewals to prolong the life of some types of buildings almost indefinitely, but if we study this statement we will see that this amounts to practically rebuilding the whole several times, for to replace the building piecemeal is more costly than to rebuild the whole at one time, and if the percentage of generally accepted depreciation on a building of a certain type has been decreased owing to its prolongation of life by these means, the cost of maintenance, renewals and repairs has increased in proportion, so that we may leave this condition out of consideration.

The sales value of many articles and equipment drops considerably as soon as they are put into use, and after that the decrease in value proceeds very slowly, comparatively, while, on the other hand, from a maintenance standpoint the reverse would be true.

Automobile depreciation has been intelligently grappled with and the tabulated results are well understood and generally accepted.

A mortality basis similar to that used in connection with automobiles or plant units is the most satisfactory basis for computing depreciation, and some recognized scale of life values should be used and adapted to the classes of buildings under consideration. When this is generally adopted, the task of computing the depreciation is simplified, and of the many methods in vogue, that known as the *straight line formula* is the most simple and accurate, which is:—

> Annual depreciation in buildings shall be calculated by dividing the sum of the total investment, minus the probable final salvage value, by the given number of years of estimated life of building at the time of its erection.

There have been cases in Canada where the estimated depreciation has not been taken wholly on depreciation of the building itself, but has been adjusted to include some portion of value as a " going concern " because the building " fulfils its efficiency " for the purpose for which it is being used. The addition of this foreign matter into the subject is very confusing and involves a mixing of the tangible with the intangible, inasmuch as the replacement value of the building at current cost can be accurately established and the depreciation on the building can be demonstrated, (subject to date of erection, structural defects, necessity for repairs and obsolescence), and the estimated present value will be the difference between the replacement value and depreciation. Therefore, it is better to deal with the building separately and leave the question of goodwill or business value to be calculated in another portion of the schedule. Thus, for assessment or taxation purposes the present value of building will be what it is intended to be, without any business entanglements, and the business will be taxed separately.

For the placing of fire insurance, the present value of building will be taken, plus a sum to cover business disturbances during period of rebuilding should the building be a total loss through fire.

In the event of selling the business or for company flotation, the present value of building or buildings will be taken as a separate item and kept distinct from goodwill and other assets in the schedule.

If the land is legally expropriated and a concern is forced to relocate or go out of business, the present value of buildings should be taken separately, and any compensation for buildings as a " going concern " should be considered separately with the adjustments for loss of business.

As an instance where a mortality basis was evidently not used, the following case is mentioned:—

A list of tables prepared and used by the Interstate Commerce Commission of the United States gives a Corliss engine a life of from 25 to 35 years, or an average of 30 years; yet there was a recent case of a Corliss engine which was second-hand when installed 35 years ago and has been constantly working since that time which was valued by the appraiser at present-day price for a new engine less 20 per cent for depreciation.

Another instance noticed recently is that of a frame office building, built in the jig-saw period forty years ago, with much turned and fretted machine-made ornament to the exterior, flimsy studded walls and the clap boards held in position by liberal coats of paint; this building, which, according to the above mentioned tables, should have an average life of 33½ years, was given a depreciation on the present-day replacement cost of 30 per cent, which assumes the estimated life of this building to be 133 years.

Frank E. Barnes, supervising building valuations for the New York Central Railroad, says of depreciation:— " The intelligent use of any rule for depreciation presupposes a careful field inspection and the full knowledge of the conditions surrounding the building, machinery, etc., on which the depreciation is to be figured. It is also assumed that the rules will be applied by one familiar with the subject of depreciation, and who will use reasonable judgment."

An Applied Example

As mentioned above, the intensity of the demand for a building or property is a governing factor in setting the sale price, but it is not the structure itself that has increased in value; this depreciates year by year. The inflated or increased price is a premium or bonus for some advantage of location, thus capitalizing the scarcity of that type of structure or property.

As an example, let us quote the case of an old wooden frame stable existing in a district in which the municipality have decided to eliminate this type of building and have prohibited the erection of any further stables in the neighbourhood and have passed building by-laws since the stable was built which are much more strict, inasmuch as any future buildings to be erected must be of brick, stone, concrete or tile. Now, as long as the owners of the existing building keep it in repair, conduct it in such a manner that no nuisance exists and provide adequate fire protection as called for by the Fire Underwriters' Association, the building may function at an inflated rental value, (because of its unique position and circumstances of the case), so long as it will stand. In the event of a sale, these circumstances would form a potent factor in determining the sale price, depending on how badly the purchaser desired that particular location.

Now, let us view this particular case in the event of the property being legally expropriated by a governing body. The owners are obliged to go outside of this neighbourhood to another where the erection of a stable will be allowed, and they will be compelled to erect a brick or concrete structure to comply with the by-laws.

It is submitted that any compensation to cover extra cost of the compulsory better type of building and the location in a position which may not be nearly so good as the original position for distributing purposes, should be segregated from the compensation for the existing building proper, and should be considered part of the business disturbance and re-establishment.

Let us go a little further with this particular case and suggest a course that may commend itself to an arbitrator or judge, if properly presented. Dealing with the building alone, we find that it was built in 1887, (forty years ago). To build a similar building, of similar materials and in like form, would cost to-day about $7,000. Considering climatic conditions, nature of soil and trade or business carried on, we will assume that this type of structure would, with small annual repairs and preservative measures, last for fifty years. Then the depreciation would be 40/50 or 80 per cent and present value would be the replacement value, $7,000, less 80 per cent depreciation, leaving $1,400 as the present value of building.

The building in 1887, when erected, probably cost $3,000, and if the business had been conducted in a proper manner, a sum for annual depreciation should have been written off as such, apart from items such as interest on capital, repairs and renewals, insurance, taxes, etc.; this sum for depreciation being $60 per year, which would in fifty years amount to $3,000, the sum invested. As forty years have elapsed, the sum of $2,400 would have been written off to the credit of the building, which, added to the above estimated present value of $1,400, would give the owner $3,800 towards the cost of the new building.

Following this case further into the field of business disturbances and loss of trade, we find that the firm whose land and building have been expropriated is compelled to erect a building of similar capacity of brick or stone, and that it will cost them $11,000. Then the difference in rental values of the old building and new for a period of ten years, (which represents the remainder of estimated life of the old building), would be a fair compensation for this item, irrespective of other business losses. This rent would be as $700 is to $1,100, a difference of $400 per year for ten years, which gives $4,000 as the extra cost of operation due to the more expensive building. This item of $4,000, together with the sum allowed for present value of building, $1,400, and the sum already written off in the books of the firm, $2,400, would amount to $7,800, leaving the owners to supply $3,200 with which to build an up-to-date, efficient building costing $11,000, with a life of at least eighty years, which would have a book value at the end of ten years, (the estimated length of life remaining to old building), of $9,625.

If the building had only been built twenty-five years, the amount written off as depreciation in the books of the firm would be $1,500 and the present value would be the replacement value of $7,000 less 50 per cent depreciation, which amounts to $3,500, and the extra cost of operation due to building the $11,000 structure would be $400 per year for twenty-five years, which is $10,000. So the owners would receive $13,500 cash with which to build the $11,000 building and cover extra taxes, and at the end of twenty-five years, (the estimated remaining length of life of the old buildings), would have a book value of $7,562 upon the new building.

Salvage

In estimating the probable salvage value of a building for any specific purpose, the engineer will do well to remember that buildings of brick, cut stone, hollow tile, structural steel or heavy lumber would yield second-hand materials for which there may be a good market, yet mass concrete and reinforced concrete structures give no saleable old materials, except for fixtures, trim and equipment.

The best method to get results is to organize a gang on paper, with necessary plant, and estimate it as a job of work, taking off rough quantities for different materials and allowing for a percentage of these materials which will be recovered, cleaned and prepared for sale. Guard fences and shoring must be considered for the protection of life and adjoining property, and provision must be made against dust. Insurance must be provided, all débris and rubbish must be disposed of and allowance made for teaming and trucking of odd materials. The approximate second-hand market price of the recoverable units may be ascertained, but from 50 to 60 per cent must be deducted from these selling prices for transportation, storage and profit. The difference between these estimated recoverable prices and cost of wrecking will be the salvage value.

Machinery and Fixed Equipment

It is not intended in this paper to more than touch upon this subject, as the types are so varied and the conclusions so debatable, but it is safe to say that the second-hand selling price is governed by the demand, and this demand is well-known and catered to by firms who make a specialty of second-hand machinery and equipment and will quote a price for or give opinion on any collection of machinery of which the engineer may make a list. This inventory should contain makers' names, trade marks and serial numbers, as well as notes on condition and efficiency and how long they have been installed and whether they have been used constantly during that time, and also whether they have been used constantly for days of twenty-four hours each, as is the custom of some industries. From this data, and from his own observance of wear and tear, efficiency and obsolescence, a good engineer can arrive at present values.

Valuators of machinery are very prone to, in a manner of speaking, put everything on the bargain counter and price the machinery accordingly, but if the business has been operated with any degree of efficiency this machinery, although well used, has a present value much more than the salvage or bargain value, and it is here that the standard compiled lists of the average useful life of all types of machinery may be used.

Business Disturbance

In cases of forced re-location by reason of expropriation, claims for business losses or business disturbance and increased cost of production are many and varied, and only a few of the more common questions that arise will be mentioned here:—

(1) Moving machinery, equipment, stock and fixtures.

(2) Renting temporary premises until new premises are ready.

(3) Increased cost of deliveries from new location.

(4) Loss of business directly traceable to the change.

(5) Increased cost of carrying on business, by reason of an expropriation forcing a business concern to spend money on new buildings that they would not otherwise be called upon to do during the operation of the existing lease or a certain period of years.

The first three of these items are easily calculated, but the fourth is one that only time and the books of the business can show, and if claimed, and a direct settlement is desired, should be made the subject of discussion with full access to the books of the business for corroborative evidence.

Providing no argument can be successfully maintained that would prove increased efficiency, cheaper and better production costs or other important advantages to partly or wholly offset this increased cost, it would appear to be the fairest way to calculate this increased cost referred to in the fifth item by multiplying the difference between the estimated rental value of the old building and the estimated rental value of the new building by the number of years already agreed upon as the remaining useful life of the existing building, this sum representing the increased cost to be taken care of in business disturbance.

One might naturally ask, why rental values? By rental values is meant fair rental values on both buildings, calculated by including the same minimum percentage of profit on the invested capital for both and estimating separately a sufficient annual depreciation; also an annual sum for decorations and superficial repairs; annual sums to replace any parts of the equipment or building that might need renewing before the life of the more permanent parts of the building has ended; also, an annual sum for fire insurance, taxes on land and building; a percentage for rental lost by the building being vacant for a period during its life; in short, everything that a fair rental value should mean, viz., a sufficient annual sum to make the building self-supporting for the duration of its estimated life and return a fair interest on the invested capital, irrespective of the problematical rise and fall of land or building values.

Perhaps in the foregoing there has not been much established as to hard and fast rules to be observed. It has rather been a citation of cases, of snags that are likely to occur and of debatable points which the valuator may expect to have to do battle with, but it is hoped that it has made clear the fact that the necessity for more detailed valuations at frequent intervals is becoming greater every year, and it behoves the engineer who intends to specialize on this work, or who may wish to be able to do this work on occasions, to familiarize himself with the taking off of quantities of every trade in building construction, from plans or the actual work, together with the recognized trade allowances for difficult work, deductions for openings, etc., to understand the qualities of building materials, and to keep in touch with market prices of materials, local conditions and rates of pay for labour. He should also set up his own method of short cuts for preparing preliminary quick estimates or for proving or checking detailed estimates; and who is better equipped to study and specialize on this work than the professional engineer?

Bearing Metal Bronzes*

The Essential Constants of Bronzes in Every Day Use as Determined by a Series of Tests with Metals Carried Out Under Practical Working Conditions

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and

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The engineer frequently has occasion to look up data relative to bronzes, and often finds that he cannot get such data all on the same metal under the same conditions, and, further, that where details of the conditions prevailing are not clearly stated it is difficult to be certain that the various data secured from different sources are strictly comparable. While it is not claimed that the present investigation is complete, an attempt has been made to contribute something that it is hoped may be of use to Canadian engineers because it deals with Canadian conditions.

The question may arise, can a cheaper alloy be used for some given set of conditions that will be equally as satisfactory as a more expensive product? This in turn brings up the matter of specifications and the question as to whether all virgin metals must be specified, or whether good used metal is permissible, it being obvious that insofar as cost is concerned the use of good used metal is much more economical, not only as to price paid, but also as to the utilization of material.

All too rarely does one meet with a metal specification drawn up in such a manner as to give the purchaser the article best suited to his purpose for the fairest and most reasonable price. Such a specification must demand only an article that can be manufactured under ordinary conditions, for a price that shall be fair alike to both buyer and seller. To ask for a bronze, for instance, to be made out of unnecessarily high grade metal, expecting, at the same time, to purchase it at an extremely low price is unreasonable. It would be far better to require a product to pass certain rigid minimum tests irrespective of the origin of its component parts, provided that such tests are known to adequately ensure the product being thoroughly sound.

Although the alloys were all made especially for the experiments referred to in this paper, they have nevertheless been fabricated under strictly commercial conditions. Melts of the ordinary amount and metals, either virgin or used metals, as ordinarily obtainable on the open market were employed. In some cases the bronzes were made entirely from used metal with results equal to virgin metal, as shown by the constants obtained.

Altogether some three hundred tests were made, involving between eight and nine hundred measurements, and the figures given are based on the averages, the maximum and minimum of which differed but slightly.

The following alloys formed the basis of this investigation:—

No.	Tin %	Lead %	Zinc %	Copper %	Phosphorus %
1.	..	..	40	60	....
2.	..	..	30	70	....
3.	4	4	4	88	....
4.	8	15	1.5	75.25	....
5.	8	15	..	77	....
6.	10	10	..	80	....
7.	10	..	2	88	....
8.	10	..	..	90	0.25
9.	17	..	..	83	....
10.	Manganese bronze (copper-zinc alloy)				
11.	Lumen bronze (zinc-copper-aluminium alloy).				

AUTHORS' NOTE.—* In presenting this paper the authors desire to state that it is intended to present the most essential constants of the bronzes in everyday use, all of which have been determined on the same lots of metal under strictly commercial conditions, conditions which you may reasonably expect to have fulfilled in any bronze foundry operated under modern scientific control.

In discussing the question of the forms of crystals and the phases of various alloys, the terms "eutectic" and "solid solution" are used. Perhaps one may be pardoned for making an explanation in regard to these words. This can perhaps best be accomplished by taking a concrete example.

The metals lead and tin if melted down together, cast, and allowed to cool, form an alloy which differs in its structure according to the ratio of these two metals present.

If 63 per cent of tin and 37 per cent of lead be melted up together and the source of heat shut off, a thermometer being inserted in the molten metal, it will be found that the temperature recorded on the thermometer will steadily fall until a temperature of 358° F. is reached, at which point there will be a period during which no further drop in temperature occurs. When the thermometer records a decrease in temperature again it will be found that the whole of the metal has become solid. The melting point of this alloy is, therefore, 358° F. The melting point of lead is 621° F., and that of tin 450° F.

If the alloy just referred to is melted again and some tin or some lead added to it, the point at which the alloy becomes solid will be found to be higher than was the case in the first alloy. This, notwithstanding the difference in temperature of the melting point of the two metals, whether tin or lead are added, the temperature of the solidification point is raised. It follows, therefore, that the alloy mentioned, containing 63 per cent tin, is the lowest melting point alloy of the series lead and tin. Such an alloy is called an eutectic, from the Greek word meaning well melting.

Putting it in the form of a definition, an eutectic is the lowest melting point alloy for any given series of metals.

The term solid solution may at first seem paradoxical, but this is merely because we are apt to consider solution as taking place only in the liquid phase, whereas it can equally well take place in the solid phase.

When copper sulphate goes into solution in water the resultant liquid shows no sign of the crystals of copper sulphate, nor of the characteristic appearance of water; in other words, their identity is merged the one into the other, and they cannot be recognized by ordinary physical means.

A piece of cast steel, upon examination under the microscope, will be found to consist of a network of large white crystals on a dark background. If such a piece of steel be heated to a temperature above 1,652° F. the steel will still be solid and at a red heat, but at this temperature all the crystals will have disappeared. They will have gone into solution, or the crystals and the dark background will have dissolved, the one into the other. Inasmuch as the steel has been solid throughout the operation, one could say that the crystals have gone into solid solution. It follows that an alloy that is made up of solid solutions has a uniform appearance under the microscope, because the various constituents are merged into each other, with complete loss of identity.

Another example is that of ordinary brass containing 70 per cent copper, 30 per cent zinc. The alloy is a solid solution alloy, the copper and zinc being soluble in each other, and therefore there is only one phase.

If, on the other hand, we take a brass containing 60 per cent copper and 40 per cent zinc, the alloy is not a solid solution, but crystals of one kind of brass are to be seen in a matrix of another form of brass. It is, therefore, impossible to identify the constituents of an alloy which are in a state of solid solution.

On these alloys the following constants were determined:

(a) Composition
(b) Metal cost
(c) Yield point
(d) Tensile strength
(e) Elongation
(f) Deformation limit
(g) Brinell hardness
(h) Sclerescope hardness
(i) Compression at 50,000 pounds
(j) Compression at 100,000 pounds
(l) Weight per cubic foot
(m) Microscopic structure.

Where pertinent the above tests were made on:—

(1) Original melt
(2) Remelt
(3) Annealed metal.

It was thought that the best thing would be to present all these tests together and then discuss the various points that suggest themselves. The following details indicate the manner in which the various bronzes were fabricated, and also the metal used and final product:—

Metals Used

Copper—Copper trolley wire.
Tin—William and Harvey pig tin.
Lead—Kingdon lead.
Zinc—Tadanac slab zinc.
Aluminium—99% or over, virgin ingot.
Phosphorus—As phosphor copper 15% phosphorus.
Manganese—As manganese copper 30% managanese.

Melting Unit Employed—City gas gas-fired crucible furnaces, using a 35-pound crucible.

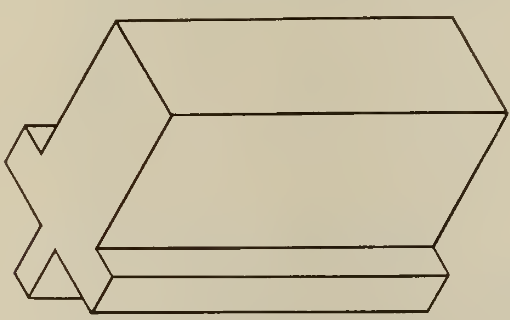

Figure No. 1.—Keel Block Test Bar.

The various alloys were founded in accordance with standard metallurgical practice, at least two hundred pounds of each being used, and poured at the temperatures indicated into green sand "keel block" test bar moulds and left undisturbed until cold. The excess metal, over and above that required for test bars, was cast into ingots. These ingots and the test bar blocks, minus the test bars, were then remelted and cast as "remelt" exactly as before. Some of the test bars of each melt were placed in a "Hump" electric furnace and slowly heated during two hours, to 1500°F., and maintained at that temperature for one hour and then allowed to slowly and regularly cool to room temperature, taking eighteen hours to do so. These bars were marked *"A"* following their ordinary numbers.

Attention is drawn to the form of the test bar, shown in the accompanying figure No. 1, (which is not original), as being one which gives no undue chilling effect but rather conditions that are frequently duplicated in heavy cross-sections of fairly large castings, so that it is reasonable to assume that castings of smaller cross-section will be stronger and not weaker than the tests, although probably, in some cases, having less ductility. The amount of metal required for such a test bar block is from 40 to 50 pounds, the rate of cooling is slow and the resultant grain size "average." The same form of test bar was used for all tests.

In the case of forged manganese bronze, one of the lower bars was heated in a blacksmith's forge until a bright red heat had been reached, soaked at this temperature, and then placed under a steam hammer and forged down from 1⅝ to 1 inch square, the bar still being red hot when finished.

Preparation of Test Specimens

The bars for tensile strength were turned according to American Society for Testing Materials specifications; finished 0.505-inch diameter, distance between punch marks 2 inches, ends left rough and held in slotted steel grips. The bars were then smoked and the yield point taken at that point at which a double line appeared when scribed from a fixed point on the bar. No attempt was made to notice the first 1/1000th of an inch elongation, the whole of these tests being conducted on essentially practical lines calling for as little super-refinement as possible. The machine used for the tensile and crushing tests was an Olsen 100,000-pound capacity, multiple lever type, and in the case of yield point and tensile tests was run at its slowest speed. This gave an average rate of loading of 2,000 pounds per minute. In the case of the compression tests the average rate of loading was 20,000 pounds per minute, and the load was reapplied when necessary until the beam remained stationary for ten seconds. This means that the specimens really supported the loads indicated. The test pieces for compression tests, unless otherwise indicated, were cylinders of one square inch area, one inch high. All measurements of height were made with a micrometer sensitive to 1/10,000 of an inch. In a few cases cubes were used instead of cylinders. The devices used for tensile and compression tests are shown in figures Nos. 2 and 3.

Brinell Tests

These were made on pieces cut from the ends of the tensile test bars. The inside tests were made on the cross-section and the outside tests on the face of the rectangular ends after machining and grinding off about 1/16 of an inch. A load of 500 kilogrammes was maintained for thirty seconds. In some cases the load was applied for ten seconds, fifteen seconds and forty-five seconds with no change in the figures. Again, in the case of the hard alloy No. 9 the Brinell figure of 150 was obtained with 500 kilogrammes for thirty seconds, and a check using 3,000 kilogrammes for thirty seconds gave a figure of 149. Manganese bronze gave similar results. Brinell formula hardness number equals $\frac{L}{A}\,{}^{5}\sqrt{p}$ where L is load in kilos, A is superficial area of concave surface of indentation and p the radius of the ball, in this case 10 mm.

Microscopic Investigation*

Pieces were taken from test bars and prepared in the usual manner and represented original melt, remelt and annealed specimens. Each of these were photographed, unless otherwise stated, at 100 diameters, both *plain polished* and *etched*. The photomicrographs represent the average condition of the metal, unless otherwise designated. Some seventy photomicrographs were taken in all and thirty representative illustrations have been prepared for this paper.

* For the purposes of publication these photo-micrographs have been reduced to 75 diameters, and due allowance must be made when comparing the measurements given in the text with measurements made on the accompanying illustrations.

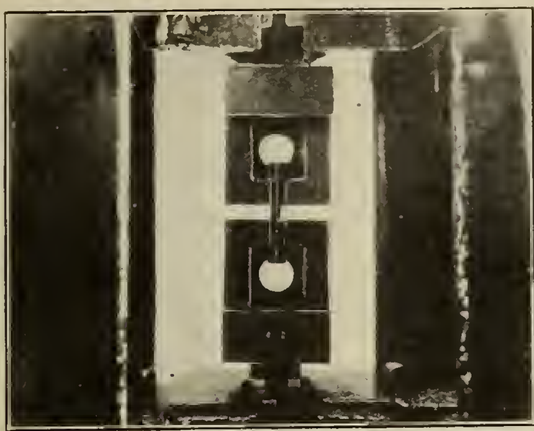

Figure No. 2.—Tensile Test Apparatus.

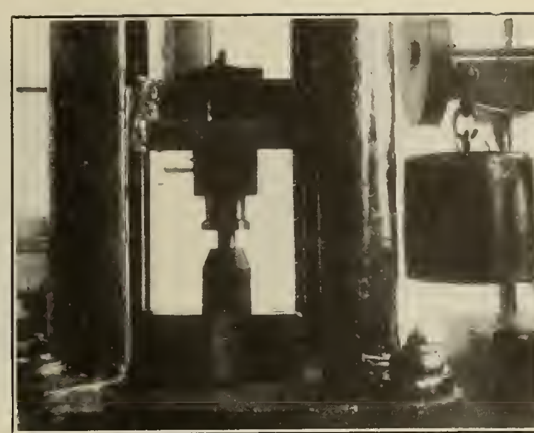

Figure No. 3.—Compression Test Apparatus.

Metal Cost

The bronzes have been arranged in order of the cost of their component metals, including the addition of 5 per cent to cover foundry loss. The base prices used were as follows:—

Tin	70 cents per pound
Lead	10 " " "
Zinc	9 " " "
Copper	16 " " "

These are metal prices only and do not represent in any way the foundry cost.

Apart from the usual data submitted, the writers feel that the following items of interest are worth discussion:—

(1) That the casting of an alloy into ingots and subsequently remelting these for the actual casting is not a necessity and it does not necessarily make for a metal having superior constants, provided that the original melting and alloying were properly carried out.

(2) That the increasing of lead and the decreasing of tin in a bronze does not necessarily soften it, and that therefore lead can be used with greater freedom than some have thought, provided that it is properly alloyed.

(3) That a bronze made from a good used metal will make just as satisfactory castings as when virgin metal is employed, with a natural saving in cost. It is better to pay an increase in price for superior metallurgical practice resulting in good castings from used metal rather than for the use of virgin metal with inferior metallurgical practice resulting in poor and defective castings. This is contrary to the fairly widespread idea that one should be ashamed to admit the use of used metal, but always state that virgin metal is exclusively used.

(4) That a white metal alloy composed of zinc, copper and aluminium can be satisfactorily used in place of the more costly high tin bronze for heavy pressure duty such as bridge turntables, etc.

(5) That in requiring the Brinell hardness figure as part of a specification for a bronze a clear statement should be made as to where and how such a test is to be applied.

Taking up the first point raised, referring to the data chart, table No. 1, you will notice that comparing the yield point and tensile strength figures for the original melt and the remelt for alloys 1, 3, 5, 6, 7, 8 and 9, that the original melt is either equal to or better than the remelt in each of the cases cited. The fact that the difference is very little would indicate that the remelting properly conducted is not injurious, and on the other hand that the original alloying had been such as to produce a satisfactory metal. It is probable that the idea of calling for a remelting of bronzes was to ensure double mixing of the constituents. Insofar as mechanical stirring of the molten metal is concerned, the remelting has this advantage in that the stirring is conducted twice over, as well as the fact that an unhomogeneous ingot may to some extent stabilize itself on remelting and give a more uniform alloy. It is the authors' contention that if the right care is taken in the first place in alloying, including the mechanical mixing where necessary, there is no need for further melting of the metal. On the other hand, it should be quite possible to melt metal several times under the right conditions without loss of mechanical properties. An extreme case of this came to the writers' attention, namely, the remelting of manganese bronze twenty-three times with almost negligible reduction in the physical constants. The saving of an extra melting, other things being equal, should make for economy on the part of the purchaser.

Passing to the second item, dealing with the addition of lead, it will be seen by referring to alloys 6, 5 and 4, under the heading of Brinell tests on the inside of the bars, that alloy 6 has 10 per cent of tin and 10 per cent of lead. In the case of 5 the tin, which is commonly looked upon as the hardening constituent, has been reduced 2 per cent and the lead, which might be considered the softening consti-

No.	Analysis: Tin	Lead	Zinc	Copper	Phos.	Iron	Alum.	Mag.	Temperature Cast	See Note A Metal Cost	Yield Point	Tensile Strength	Elong.	Deformation Limit	Brinell Test 500 Kilos 30 Secs: Inside Dia.	Inside No.	Outside Dia.	Outside No.	[illegible] Test	Compression for 1" Cylinder at 50 000	at 100 000	Weight per Cubic Ft.	No.
1		0.35	40%	60%	0.01%				1850°F	13.06	15000	43600	47%	10000	315	63	300	70	13	—			1
11											13900	42500	49%	10000			285	77		0.130		521	11
1A									Annealed 1500°F		13000	40500	54%	9000	315	63	305	67					1A
2		0.35	30%	70%	0.02%				2050°F	14.59	7500	23500	41%	7000	390	39	390	39	10	0.259			2
22														7000			370	45		0.260		524	22
2A									Annealed 1500°F		6900	20000	28%	5000	410	36	350	50					2A
3	4%	4%	4%	88%					2050°F	18.52	16200	28500	27%	10000	345	52	295	72	13	0.215			3
33											16200	28000	27%				290	74				543	33
3A									Annealed 1500°F		15500	29200	23%	10000	330	57	295	72					3A
4	8%	15%	15%	73.25%	0.015%	0.25%			1950°F	20.26	14100	25000	19%	12000	335	55	310	65		0.197			4
5	8%	15%		77%	0.01%				2050°F	20.39	15200	25700	18%	12000	335	55	300	70	13				5
55											13400	24600	14%				290	74				586	55
5A									Annealed 1500°F		16700	21100		15000	325	60	320	61					5A
6	10%	10%		80%	0.024%				2050°F	21.84	17500	31600	21%	15000			290	74	18	0.165			6
66											16600	23300	10%	15000	335	55	280	80		0.164		556	66
6A									Annealed 1500°F		20000	38400	27%	15000	290	74	280	80					6A
7	10%	0.05%	2%	88%	0.02%				2050°F	22.32	18500	41700	34%	15000			260	93	16	0.40			7
77											18200	35400	25%		290	74	260	93				543	77
7A									Annealed 1500°F		19200	42000	45%	15000	295	72	285	77					7A
8	10%	0.05%		90%	0.04%				2050°F	22.47	21400	43300	29%	15000	275	83	250	100	18	0.170			8
88											16000	33200	18%				250	100				556	88
8A									Annealed 1500°F		20700	39600	27%	15000	275	83	295	72					8A
9	17%	0.05%		83%	0.04%				2050°F	26.43	26100	26100	0%	25000	255	96	205	150	24	0.024	0.144		9
99											26100	26100	0%				210	143				536	99
9A									Annealed 1500°F		23600	23600	0%	20000	230	119	225	174		0.051	0.193		9A
Note B 10	1%	0.5%	36.5	59%		1%	1%	1%	1600°F		30000 27200	72700 65000	37% 31%	20000	235	114	240	109	17 Outside 18 Inside	0.036	0.177	524	Note B 10
10A									Annealed 1500°F		26400	58700	23%	20000	235	114	245	105		0.053	0.194		10A
10F									Do not red heat (?)		45000	71000	31%		225	140	215	136					10F
11			86%	10%			4%		1250°F		30700	30700	0%	25000	225	124	225	124		0.015	0.189	432	11

NOTE A: Copper [illegible] Tin [illegible] Zinc [illegible] Lead [illegible] NOTE B: ALL TEST BARS CAST IN 50 LBS KEEL BLOCK AS PER DRAWING AND LEFT IN THE GREEN SAND TILL COLD [illegible]

Table No. 1.—Data Chart—Bronze Bearing Metals.

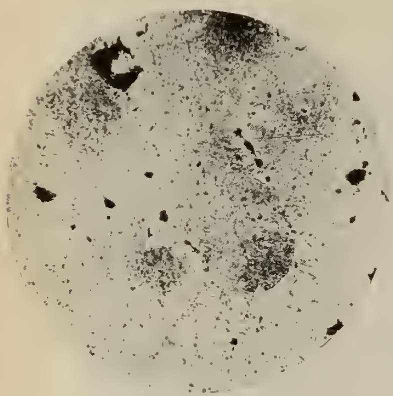

Figure No. 4.

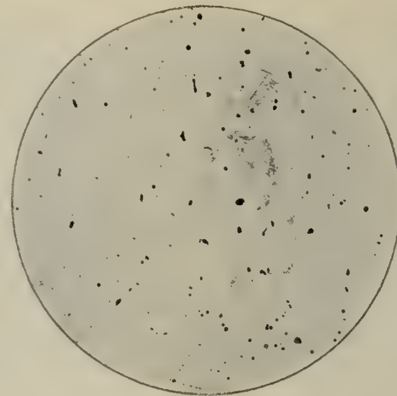

Figure No. 5.

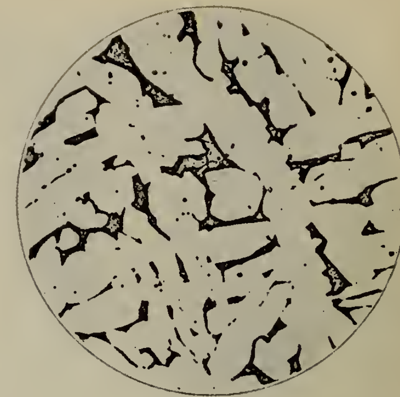

Figure No. 6.

tuent, has been raised 5 per cent. A similar reduction of tin and increase in lead has been made in the case of alloy 4, with the further addition of what is commonly looked upon as a softening agent, namely, 1.5 per cent of zinc. All these changes producing alloys having the same Brinell hardness, namely, 55. If it be a fact that the addition of lead does not produce a softer metal, at least within the limits referred to, then one of the serious objections raised to leaded bronzes for acid resisting purposes in pulp and paper mill work has been removed. Several tests made in recent years have all tended to show that practice bears out the theory just stated. Again, it is commonly stated that lead would be the ideal bearing metal were it only possible to retain it in position under the conditions of hammering and pressure to which bearings are subjected. It is not unreasonable to argue from this that the more lead one can get into a bearing the better, other things being equal.

Turning to the third item, dealing with the relative merits of used and virgin metal, alloy 5 was made from virgin metal and alloy 4 from metal that had been used many times, both being of essentially the same composition. The alloy made of used metal has practically the same tensile strength as the new metal, and has practically the same elongation, in fact, in this particular instance, a trifle better elongation. Elongation is the figure most affected by remelting. The deformation limit is common to both, as also is the Brinell test on the inside of the bars. The microscopic investigation discloses no appreciable areas of oxide, which is a common impurity of poorly melted metal. Although this is the only case illustrated in the present paper, it is only one of many which have come under the writers' attention over a period of many years.

In connection with the fourth item, comparing a zinc alloy with a high tin bronze for heavy pressure duty, very little discussion is required so far as the present figures are concerned. The tests required for alloys subjected to heavy pressure and slow movement are the deformation limit and the Brinell hardness. The deformation limit of the high tin alloy 9 is 25,000 pounds, that of alloy 11, a white metal bronze, is the same. The Brinell hardness of the inside of the bars is 96 for alloy 9 and 124 for alloy 11, the outside of the bars gave for alloy 9, 150, and for alloy 11, 124. At the same time the annealed sample of alloy 9 gave 124 Brinell hardness, or the same as alloy 11. Comparing the compression at 50,000 pounds, alloy 9 had 0.024 inch compression and alloy 11 only 0.015 inch. At 100,000 pounds, alloy 9 gave 0.144 inch for the virgin metal and 0.193 inch for the anneal, as against 0.189 inch for the white metal bronze. Neither bronze has any elongation, so that there is practically nothing to choose between them as far as these tests go, and there is a distinct saving to be made by the use of the white metal bronze. The use of such a white metal bronze in large bridge work has been frequently demonstrated. A warning should be given here to the effect that such a white metal bronze requires extreme purity of its constituents and extreme care in handling, as for that matter does any high grade bronze.

The fifth point, namely, the need for stating clearly under what conditions Brinell tests are to be made, brings to notice the fact that in nearly every case the cross-section of a test bar gives a lower Brinell number for hardness than the outside portion of the bar. The fabrication of a piece of bronze generally requires that it be machined and, unless the metal removed be heavier than usual, the hardness that the tool encounters is that corresponding to the figures given as outside Brinell figures. This may be the figure the engineer desires to control in order to assure as low a machining cost as is consistent with the alloy in question. If, on the other hand, the engineer desires to use the Brinell figure as a measure of the strength of the material, and a very distinct relationship is shown between the Brinell figure and the tensile strength, he would require that the inside or

Figure No. 7.

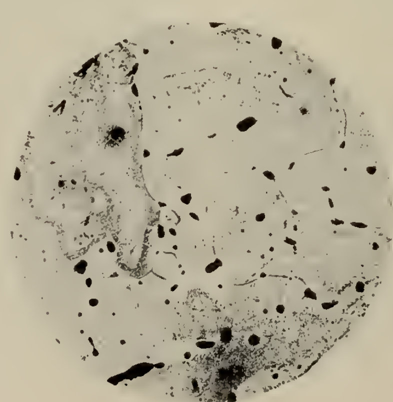

Figure No. 8.

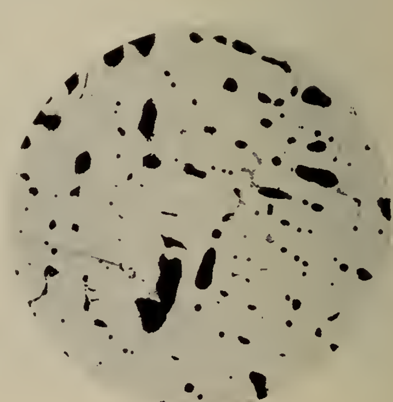

Figure No. 9.

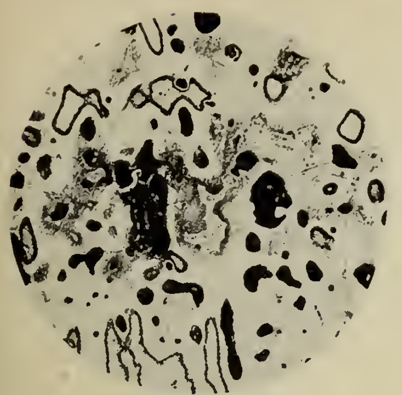

Figure No. 10.

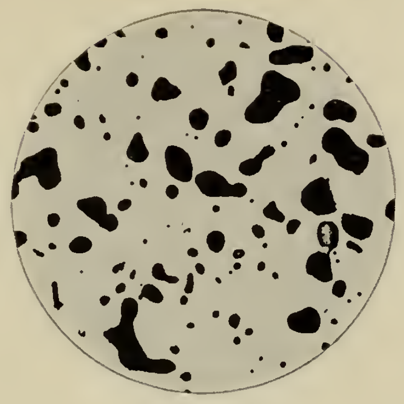

Figure No. 11.

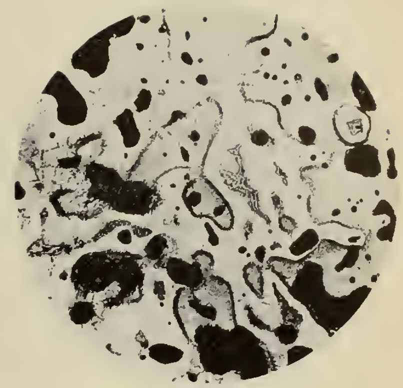

Figure No. 12.

cross-section of the test bar be used for the Brinell figure, which lower figure more truly represents the average of the cross-section of any reasonably heavy casting. The reason for the difference between inside and outside is, of course, obvious, namely, the chill effect and consequent reduction of the grain size.

There are several points of interest that might be discussed, such as the size of the lead particles as affecting the physical constants and some particular discussion in regard to the alloy manganese bronze, an example of which is given as alloy 10 of this series. It will, however, probably be better to discuss each of the photomicrographs in turn.

Yellow Brass

Figure No. 4 shows the characteristic structure of alloy 2, the yellow brass carrying 0.35 per cent of lead. On the upper right-hand corner will be noted the crystal boundary, which in itself indicates that the sample has been etched. The whole metal is formed of a solid solution. The black areas are the lead areas, the largest of which, at seven o'clock, has an actual measurement of 1/600 of an inch. When such an alloy is annealed, the only change one expects is an increase in grain size, which has a marked effect on the elongation. The coarser the crystals the less the elongation, which, in this case, fell from 41 to 28 per cent. There is not much effect on the hardness of this class of alloy, insofar as unworked metal is concerned.

Muntz Metal

The plain polished metal of alloy 1 is illustrated in figure No. 5, and shows the presence of lead particles, representing the 0.35 per cent present, the largest of which is 0.0006 inch in diameter and the smallest visible particle on the photograph approximately one-tenth this size. If there were any oxide areas in this metal they would show up in a manner similar to lead. Upon etching this sample we obtain the result as shown in figure No. 6. Here we see that two constituents are present, the light ground mass being alpha brass and the dark being beta brass. It is the presence of this beta constituent that makes this alloy forgeable at a red heat, whereas the yellow brass is not etched so as not to show the alpha crystals, therefore throwing the beta in relief.

Alloy 3, plain polished, containing 4 per cent of tin, lead and zinc respectively with 88 per cent of copper is shown in figure No. 7. The 4 per cent of lead is more or less uniformly distributed, the largest particle measuring about 0.0004 inch. A freak chain of lead particles will be noticed running across the centre of the photograph.

The same alloy, etched, is shown in figure No. 8, as evidenced by the crystal boundaries. This is evidently not an annealed sample, as the shaded portions show unhomogeneous solid solution. The lead areas are more or less spherical in nature, and as such do not exert a harmful influence such as would be the case if the lead areas were attenuated and lying between the grain boundaries.

Figure No. 9 shows alloy 6, plain polished. The plain polished photograph shows the lead particles, as usual, but in addition the presence of tin-copper compound containing possibly a little copper-phosphorus compound in the form of a triple cutectic. This substance is very hard, as is shown by its standing out in relief in the course of polishing. These areas are visible in the centre of the field.

In figure No. 10 is shown the same alloy, etched. The etching brings out the tin-copper compound, and this particular area was chosen as showing the maximum size of lead particles as found in this alloy. One of the largest measured 1/200 of an inch in diameter. The average physical characteristics of this alloy are quite satisfactory, notwithstanding the presence of the apparently large particles of lead.

Figure No. 11 represents the alloy 5, containing 8 per

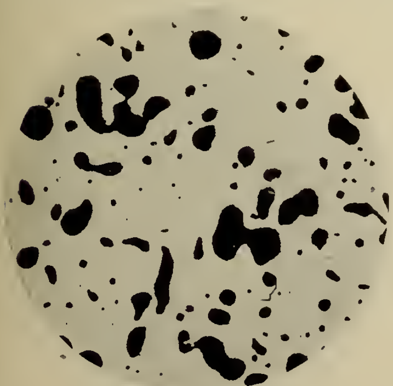

Figure No. 13.

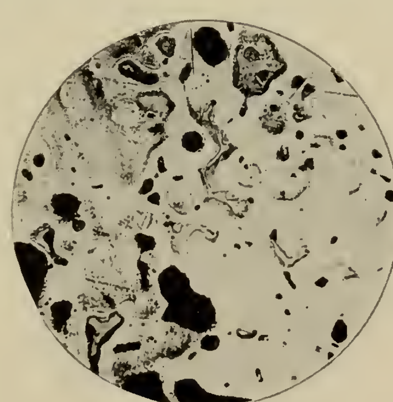

Figure No. 14.

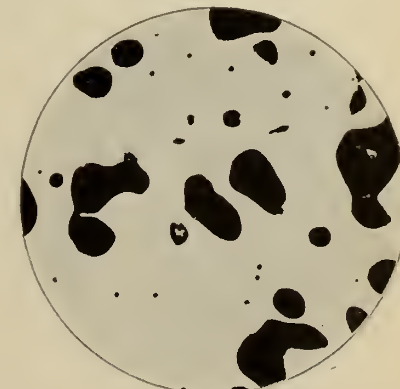

Figure No. 15.

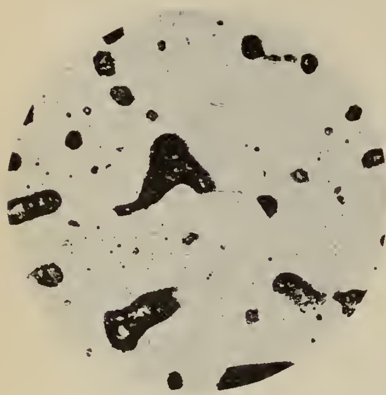
Figure No. 16.

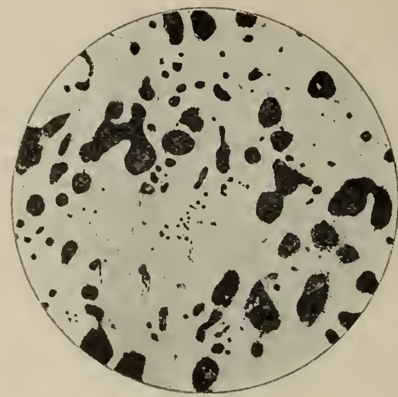
Figure No. 17.

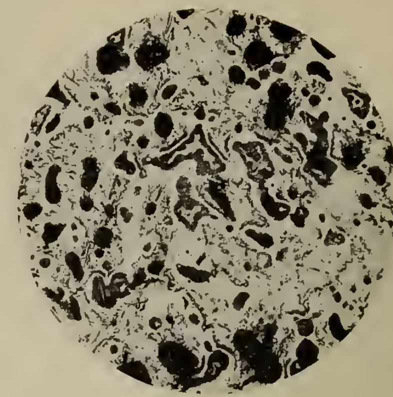
Figure No. 18.

cent of tin, 15 per cent of lead and the balance copper. There is comparatively uniform distribution of lead, the maximum particle of which measures about 1/200 of an inch in diameter.

The same alloy, etched, is shown in figure No. 12. The grain boundary, the unhomogeneous solid solution and the presence of the tin-copper compound, as before described, will be noticed.

Figures Nos. 13 and 14 show the remelt, plain polished and the etched specimen, respectively, the structure being similar to the original melt.

In figure No. 15 is shown the annealed sample, plain polished. This shows the increase in size of the lead particles, from an average of 1/400 of an inch to an average of 1/200 of an inch. This increase in size of the lead particle in the annealed specimens over and above the unannealed, which has occurred in several of the alloys under discussion, indicates the possibility either of the lead, which is molten at the temperature of anneal, coalescing through minute fissures existing in the metal at that temperature or of the lead dissolving some of the alloy in itself and thus increasing in size, or both. It will be noted that the deformation limit of this sample is higher than for the unannealed, which indicates that the increase in size of the lead particles does not adversely affect its resistance to crushing strain. It will also be noticed that the Brinell number is higher.

Figure No. 16 shows the annealed area etched. In comparing this with the previous etched sample, it will be observed that the tin-copper compound has all gone into solution, leaving the alloy in the solid solution form, showing only the lead particles and grain boundaries. It is probable that it is this absorption of the hard tin-copper compound that is the reason for the increase in hardness of the annealed specimen. The average size of lead in the annealed specimen is 1/200 of an inch, and you will note that this gives satisfactory physical properties.

Figure No. 17 shows alloy 4, plain polished, which was made entirely from metal that had been used many times. It contains 8 per cent of tin and 15 per cent of lead, as did the metal shown in figure No. 13. The reasonably uniform distribution of lead particles, the average size of which is about 1/400 of an inch in diameter, is clearly indicated. Notwithstanding the numerous remeltings of this alloy, no appreciable areas of oxide were found therein. These, if present, would appear as irregular formations of a similar appearance to lead. The lead particles have been tested by scratching them with a needle under the microscope and turning up the fresh blue surface of lead. When the suspected lead area is large enough, that is to say, not less than 1/1000 of an inch in diameter, this is the most satisfactory test to apply, although some patience is required.

The next illustration, figure No. 18, is the same area etched, showing the lead areas and the unhomogeneous solid solution and, particularly in the centre, some tin-copper compound.

One of these areas of tin-copper compound, magnified at four hundred diameters, is shown in figure No. 19; the large " shell hole " representing one of the lead particles at this higher magnification. It will be noticed that with the lead areas of the size mentioned the physical characteristics are satisfactory.

Figure No. 20 shows the annealed alloy 8, plain polished, containing 10 per cent tin and 87 per cent copper, and indicates the largest individual lead areas present in an alloy supposed not to contain lead; these areas measuring approximately 1/500 of an inch. The finding of such leaded areas caused us to make an analysis of the alloy for lead, 0.05 per cent of which was found to be present. This emphasizes, therefore, the fact that the occasional presence of lead particles in an alloy, although apparently considerable in some microscopic field, may represent only a trace of lead present in the melt. The alloy gives a particularly high

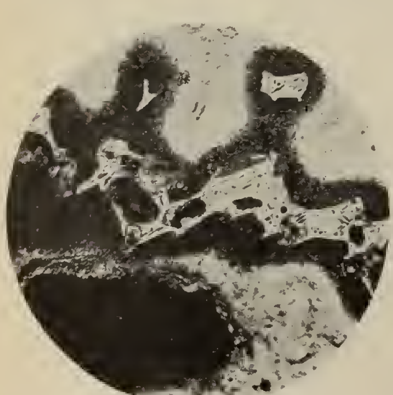
Figure No. 19.

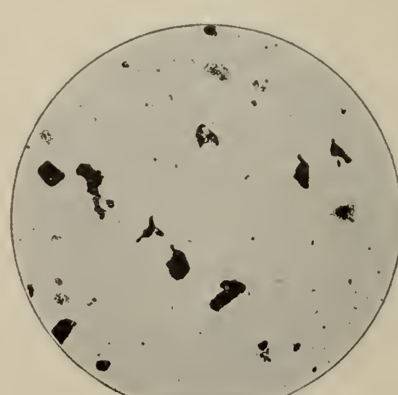
Figure No. 20.

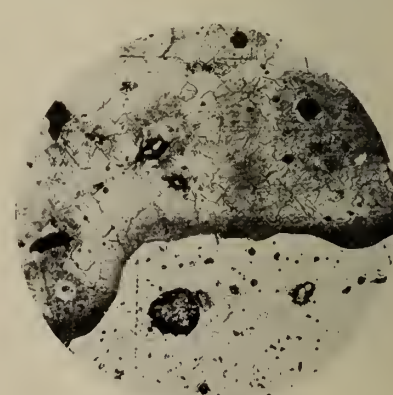
Figure No. 21.

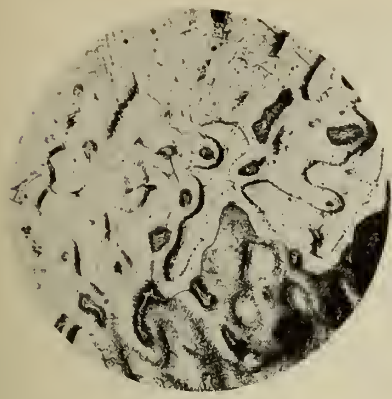

Figure No. 22.

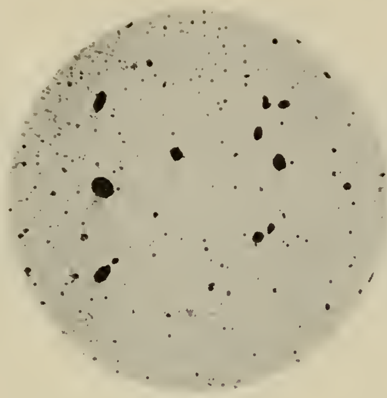

Figure No. 23.

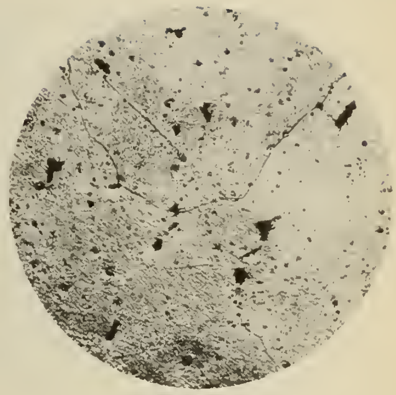

Figure No. 24.

tensile strength and good elongation and the deformation limit is high.

The same area etched is shown in figure No. 21, and gives a particularly good example of the crystal boundaries and serves to illustrate the fact that these differences in colour of the crystals are due to the orientation of light, the proof of which is that, if you change the angle of light upon the specimen, the dark crystal will become light and the light crystal dark, which obviously cannot be due to an inherent physical property of the crystal, save its power of light reflection. This is one of the proofs of the crystalline structure of metal.

Figure No. 22, etched, shows the typical structure of alloy 7, a sand cast Admiralty bronze, 88, 10 and 2 per cent.

In figure No. 23 is shown the plain polished sample of the annealed specimen, the average lead particles of which were a little larger than the unannealed sample, and, notwithstanding the apparently large amount of lead present, careful analysis showed only 0.05 per cent in the average of the metal.

The same sample etched is shown in figure No. 24, and, upon comparing it with figure No. 22, it will be noted that the unhomogeneous solid solution has been wiped out and that the small amounts of tin-copper compound have been absorbed. Attention is directed also to the grain boundaries and the typical solid solution structure. In this instance, however, not sufficient tin-copper compound was present to go into solution to harden the alloy. On the other hand, the deformation limit was not changed by the anneal.

Alloy 9, etched, the American Society for Testing Materials B-22-21, B alloy, is shown in figure No. 25, containing 17 per cent of tin and the balance copper. The continuous network of the tin-copper compound, which, as before stated, is extremely hard, and is supported by a comparatively soft matrix beneath.

Figure No. 26 is shown because it gives a good example of an unsatisfactory anatomical structure for this or any other alloy, namely, that the hard crystals have aligned themselves along the grain boundary. From the physical results obtained, it would seem that this condition is not the average condition of the alloy, and, in fact, this was supported by further microscopic investigation. Had this condition prevailed, the tensile strength of the metal would have been lower than it was, inasmuch as the amorphous cement present at the grain boundary, and which is the strongest portion of an alloy, would have been replaced by a weaker constituent. It is the tendency of this alloy to have these crystals along its grain boundary that accounts to some extent for the fact that the elongation of this series is negligible.

Figure No. 27 is one of the same alloy, showing the maximum particles found, the size of which is over 1/100 of an inch in diameter. This time the areas represent shrinkage cavities, some of which are partly filled with oxide of tin and copper, the natural result of gas cavities where oxidizing influences can come into play. The lead content of this alloy is under 0.05 per cent as taken in the average, and the physical properties were well within the specification called for by the American Society for Testing Materials, notwithstanding the presence of some voids and oxide, as well as a trace of lead.

Turning now to alloy 10, which represents the manganese bronze, figure No. 28 shows the plain polished sample which you will notice contains three constituents, one a background which is the beta bronze, on which stand out more or less in relief the alpha bronze crystals. Standing out in still greater relief because of their superior hardness are the small white crystals, which under direct microscopic examination are of a characteristic blue colour. These crystals have been the subject of considerable research, particularly in a paper entitled "Occurrence of Blue Constituent in High-Strength Manganese Bronze,"* by E. H. Dix, Jr.,

* Trans. A.I.M.M.E., vol. 68, 1923, pp. 642.

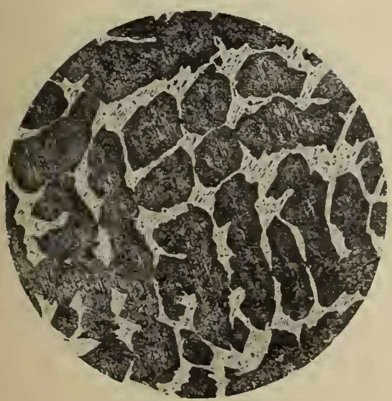

Figure No. 25.

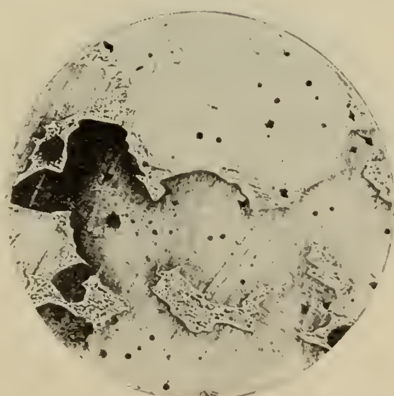

Figure No. 26.

Figure No. 27.

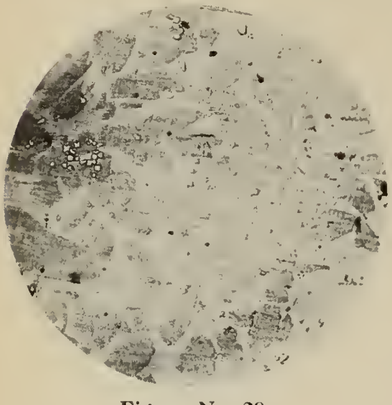
Figure No. 28.


Figure No. 29.

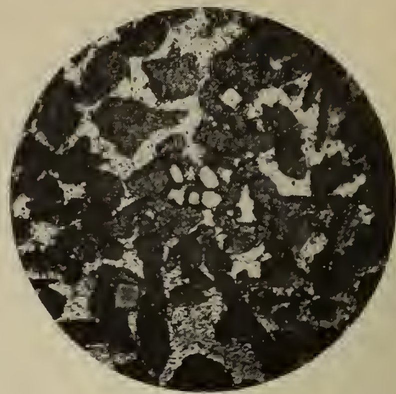
Figure No. 30.

and are considered as being composed of iron and copper, which compound, although soluble in manganese bronze alloy until the zinc is added, is by the zinc thrown out of solution. These crystals are very persistent. They occur in the sand cast alloy and persist after forging and after prolonged annealing.

Figure No. 29 shows another aspect of this condition, while figure No. 30, at four hundred diameters, shows more clearly the fact that these crystals are solid solutions.

The etched specimen of alloy 10 is shown in figure No. 31, from which will be noted the large crystals of alpha brass on a background of beta brass. The small black particles are due to the 0.30 per cent of lead that was present in this particular sample.

Figure No. 32 shows the annealed bar, which has been very little changed insofar as the size of the alpha particles are concerned. Microscopic examination of the annealed specimen, however, shows an enormous increase in growth in the real grain size of the metal, the crystals measuring something like one-half inch in diameter, as opposed to something less than 2/100 of an inch. Notwithstanding this enormous increase in grain growth, very little reduction in yield point or tensile strength is produced. It is an outstanding feature of manganese bronze that annealing, forging, or casting in chill makes but little difference in the strength, as compared with the original sand cast metal.

The original bar, after having been heated in a blacksmith's forge to a bright red heat and soaked at this temperature and forged under the steam hammer, is illustrated in figure No. 33. The data sheet shows the increase in tensile strength and yield point with no sacrifice in elongation.

Another bar, which is not shown here, was cold worked under the steam hammer, giving about the same tensile strength, but only 6 per cent elongation.

A test which may be of interest was carried out with a piece of manganese bronze sand cast, the tensile strength of which was 64,400 pounds, elongation 32 per cent at the usual temperature, namely, 72°F. The specimen referred to is the same metal, the tensile strength and elongation of which were taken when the metal was at a temperature of 332°F. below freezing, or minus 300°F. The figures obtained were, tensile strength 73,200 pounds, elongation 26 per cent. This is interesting as showing that this kind of manganese bronze may be safely used at extremely low temperatures, whereas some other alloys are extremely brittle under the same conditions. Another test bar of the same lot of metal was put under tension in the testing machine at 50,000 pounds per square inch and while under this strain was struck repeatedly with a heavy hammer so that the bar was bent, the whole of this operation being conducted at the liquid air temperature. No fracture occurred and the bar was quite sound when removed.

Another bar of the same pot of metal was secured in a vise and reduced to the liquid air temperature, and while at this temperature was bent to an angle of about 120°. The bar showed no sign of fracture or cracking, although the tin container holding the liquid air surrounding the test bar was as brittle as glass and broke as soon as the bending test was applied.

The foregoing tests show that *manganese bronze rightly made combines in itself greater strength, greater ductility and greater hardness than any other one of the ordinary bronzes*, and as such should commend itself to the engineer where such a combination of properties is desired.

Figure No. 34 shows alloy 11, which is the white metal bronze referred to as being suitable for heavy pressures where very little motion occurs, (this alloy is also successfully used for high-speed and low pressures, such as bearings, etc.).

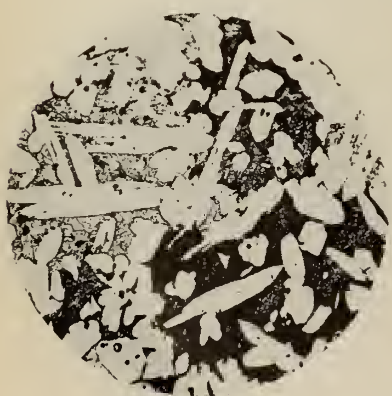
Figure No. 31.

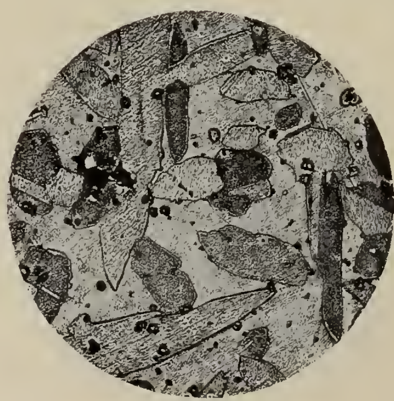
Figure No. 32.

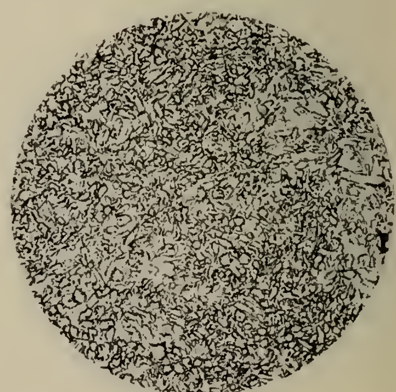
Figure No. 33.

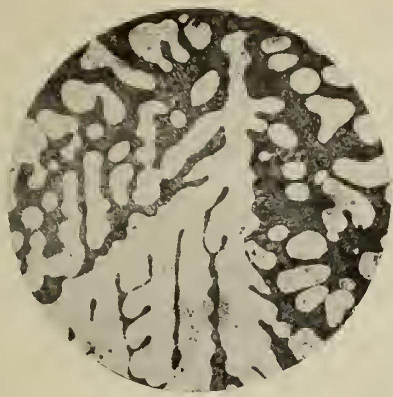
Figure No. 34.

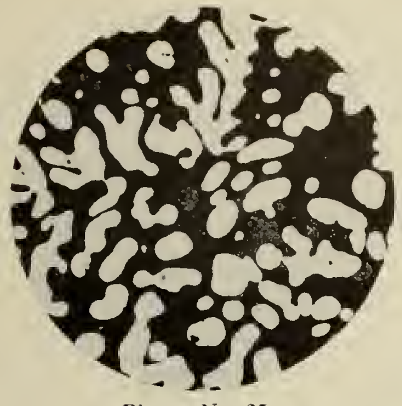
Figure No. 35.

This slide shows the unetched sample, the structure standing out in relief being zinc-aluminium-copper compound, which is much harder than the matrix and so becomes evident under the conditions of plain polishing. The matrix shows a tendency to eutectic structure.

The same area, etched to show maximum contrast, is shown in figure No. 35. This shows that this alloy has the essential characteristics of the bearing metal, namely, hard crystals to carry the load and buried in a softer matrix to permit of self-adjustment of the whole system as may be required by the irregularities of the journal.

In connection with the temperatures used for annealing the specimens, an arbitrary temperature of 1500°F. was taken intentionally, the object of the anneal being not so much to represent the correct heat treatment for each alloy in regard to the dissolving or otherwise of its constituents, but rather to obtain information as to the internal condition of a heavy cross-section of a large casting made from any of these alloys. It is reasonable to assume that the strength, structure and elongation will lie somewhere between the sand cast constants and those for the annealed metal.

In conclusion, the writers would take this opportunity of saying that the work done in connection with this paper has proved very interesting to them, and many other lines of investigation have suggested themselves as the work proceeded. The limitations of time and space have prevented the making of this paper as complete as we should have wished, but if it has provided a nucleus around which further experimental work and discussion may centre, its production will have been justified.

THE

ENGINEERING JOURNAL

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Lord Willingdon Accepts Honorary Membership

The Institute has been honoured by His Excellency the Governor-General Lord Willingdon, G.C.S.I., G.C.M.G., G.C.I.E., G.B.E., who has graciously consented to accept Honorary Membership in The Institute. Council has accordingly added his Excellency's name to the list of Honorary Members.

Meetings and Discussions

A characteristic feature of social life on the North American continent is the multiplicity of meetings and conventions of social, fraternal, professional and other organizations. Some of these take place almost on the scale of a medieval pilgrimage and involve months of preparatory work, the expenditure of vast sums of money, the wearing of gorgeous uniforms, much golf playing and travel across the continent in expensive special trains. Others, not less entertaining in their methods, and certainly exhibiting equal individual enthusiasm, draw their members from smaller areas, or are held by local bodies, but attach just as much importance to the benefit and recreation to be derived from the "convention habit."

The meetings of scientific and technical bodies are usually not carried out on such an imposing scale, are more serious in their aims and have an important influence on professional life. In the case of The Institute, it is not too much to say that our general and branch meetings are one of the principal means of carrying out the purpose set forth each month on the cover of the Journal "to facilitate the acquirement and interchange of professional knowledge among our members."

The Institute is to be congratulated on the success which has attended our meetings during the past year, not only as regards the social activities organized by the branches concerned, but also in connection with the technical sessions, the papers presented and the discussions arising from them.

Institute meetings are of two kinds, each with its own function and purpose as regards the promotion of professional intercourse.

At our branch centres, it is not reasonable to expect that the papers or addresses given every week, or every fortnight, shall invariably deal authoritatively with engineering topics of Dominion-wide interest and importance. The principal function of branch meetings, and it is a very valuable one, is rather to afford opportunities for the exchange of information and experience in regard to engineering work carried on by members of the branch or in connection with technical developments in the branch district. Less formal in their programme than the general professional meetings, they afford excellent opportunities for the younger members of the profession to take part in verbal discussion, a privilege which at the present time is not taken advantage of as it should be. Among suggestions for extending the usefulness of the branch meetings, none is more important than the organization and encouragement of discussion of the papers read. To discuss an engineering paper, a speaker must obviously have some familiarity, not only with the subject dealt with, but also with the way in which the author is treating it, and we should have a greater number of adequately prepared discussions at branch meetings, if it were the custom to furnish with the notice announcing the meeting a synopsis of the paper to be presented. It is somewhat difficult to do this, as in many cases papers are not in the branch secretaries' hands until just before the date set for the meeting, but the result would well repay the additional work. Attention to this point, and a little preparatory work by the branch committee on papers will lead to a considerable improvement in our branch meetings and in the discussions of the papers presented. Much can be done in this respect also by the authors of the papers, who are too often content with merely reading their manuscript, without giving to their presentation of the subject that personal and interesting touch which cannot be attained in reading from a typewritten copy.

As regards the general professional meetings of The Institute, it cannot be too strongly impressed upon members that if the topics dealt with are to be worthy of The Institute, and are to give, as they should, adequate recognition to the important work of Canadian engineers, it is each member's duty to see that an account of any work of this character with which he is concerned is presented first to his own national engineering society. Such papers should be more than mere general descriptions of the work accomplished, with a few statistics and particulars as to leading dimensions; they should contain a real technical message and deal with specific problems met with in design and construction, recording for the benefit of fellow-members of the profession the way in which such difficulties have been met or such problems have been solved. The majority of the papers presented at our professional meetings are of this kind, but there is room for more.

Engineers are too apt to think that because they are themselves familiar with the difficulties and every-day problems encountered in carrying out their daily duty, information on such humdrum activities will be of little or no interest to their professional brethren. This is a common error; some of the most valuable and helpful communications and discussions in The Institute's publications deal with just such topics.

Discussion is, after all, the most essential feature of a technical meeting, whether general or local, and participation in technical discussions is one of the most valuable privileges which The Institute offers to its members.

The Institute Receives Invitation to University of Toronto Centenary Celebration

There is reproduced below the invitation extended to The Engineering Institute of Canada to participate in the Centenary Celebration of the University of Toronto, which will take place in Toronto on October 6th, 1927, and the two following days.

1827 VELUT ARBOR AEVO 1927

The

UNIVERSITY OF TORONTO

to

The Engineering Institute of Canada

Greeting

ON March 15th, 1927, one hundred years have elapsed since His Majesty, King George IV, granted a Charter for the founding of a University for the Province of Upper Canada to be known as King's College at Toronto. In 1850 the name was changed to the University of Toronto, in 1853 University College was created, and under the Act of 1887 a federal system inclusive of other universities and colleges of the province was called into being. The legislation of 1906 inaugurated a period of great expansion in which the University, keeping pace with the spirit of modern learning and science, has developed its faculties and departments and is endeavouring to fulfil its function through the diffusion of knowledge and the promotion of research.

The University has decided to commemorate the centenary of the granting of the Charter of King's College, Toronto, on Thursday, October 6th, 1927 and the two following days, and is inviting the Universities and the Learned and Scientific Societies of the world to join with it in celebrating that event.

The University therefore has much pleasure in extending to you an invitation to participate in the celebration by sending a delegate on your behalf, and it will assist us in the conduct of our arrangements if the name of your representative be communicated to the Secretary of the Centenary Committee, University of Toronto, Toronto 5, Canada, not later than June 15th, 1927.

Chairman of the Governors *Chancellor.*

President.

Dated at Toronto,
March 15th, 1927

Meetings of Council

Meeting of March 15th, 1927.

A meeting of Council was held at eight p.m. on Tuesday, March 15th, 1927, President A. R. Decary, M.E.I.C., in the chair, and Vice-President J. H. Hunter, M.E.I.C., and twelve other members of Council being present.

The recommendations of the Annual Meeting were considered to the effect that the expenses incurred by authors of papers presented at branches distant from their own should be covered to a certain extent by an appropriation of Council. After discussion this matter was referred to the Finance Committee for consideration and report.

The secretary reported that he had been present at the funeral of Mr. George A. Mountain, and had arranged for flowers to be sent on behalf of The Institute. The following resolution of condolence was unanimously passed, the secretary being directed to communicate it to the family of the late Mr. Mountain:—

> Through the death of George A. Mountain, The Engineering Institute of Canada has suffered the loss of one of its oldest members.
>
> Connected with The Institute since its original inception in 1887 as the Canadian Society of Civil Engineers, Mr. Mountain, after holding office as Councillor and Vice-President, occupied the Presidential Chair in 1909, and throughout his professional career took a leading part in the activities of The Institute, and in all movements for the advancement of the interests of the profession.
>
> With great regret, the Council of The Institute records his death and extends to his family its sincere condolence in their bereavement.

Council noted with much gratification that His Excellency the Governor-General has honoured The Institute by accepting election as an Honorary Member.

In accordance with Section 13 of the By-laws, Bruno Grand Mont, A.M.E.I.C., was appointed by Council as Councillor for the St. Maurice Valley Branch for the year 1927.

Lengthy discussion took place with regard to representations submitted by the Toronto Councillors, and as a result it was decided that a plenary meeting of Council should be held in June of this year, either in Montreal, Ottawa or Toronto, to which transportation expenses of Councillors would be paid by The Institute. It was felt that the holding of such a meeting would not only fulfil the wishes expressed by members at the Annual Meeting, but would also have a very happy effect in bringing members of Council together.

A number of suggestions as to amendments in the By-laws were received and referred to the Legislation and By-laws Committee for consideration and report.

On the representation of one of the Toronto Councillors, discussion took place as to the desirability of instituting a general policy with reference to the promotion of increased interest in The Institute activities on the part of members. A small committee under the chairmanship of Professor T. R. Loudon, M.E.I.C., was appointed to investigate this matter and report at an early meeting of Council.

Life membership was granted to Mr. A. B. Ross, of Toronto, Corporate Member since 1889.

The following were unanimously appointed chairmen of the several committees on Medals and Prizes:—

Gzowski Medal and Students' Prizes Committee—
PROFESSOR C. V. CHRISTIE, M.E.I.C.

Leonard Medal Committee—
Professor H. E. T. Haultain, m.e.i.c.
Plummer Medal Committee—
J. R. Donald, a.m.e.i.c.

It was unanimously resolved that the following committees of The Institute be reappointed with the same personnel as last year:—

- Board of Examiners and Education.
- Canadian National Committee of the International Electrotechnical Commission.
- International Co-operation.
- Concrete Deterioration in Alkali Soils.
- Honour Roll and War Trophies Committee.
- Committee on Biographies.
- Engineering Education.

It was unanimously resolved that J. M. Oxley, m.e.i.c., be appointed to succeed F. B. Brown, m.e.i.c., as a nominee of The Institute on the Main Committee of the Canadian Engineering Standards Association.

Past Presidents J. G. Sullivan, m.e.i.c., Arthur Surveyer, m.e.i.c., and George A. Walkem, m.l.a., m.e.i.c., were unanimously appointed a committee to administer the Past Presidents' Fund.

The small committee which is at present studying the question of students' and other prizes under the chairmanship of J. L. Busfield, m.e.i.c., was unanimously reappointed.

The personnel of the Publication Committee, Library and House Committee and Legislation and By-laws Committee were noted and approved.

Discussion took place on the request from the Association of Canadian Building and Construction Industries for the co-operation of The Institute in the adoption of a standard form of contract for construction work. The secretary was directed to send copies of the Association's present form, together with other information to all members of Council for their consideration, the matter to be brought up again at a later date.

A letter was submitted from the secretary of the Canadian Engineering Standards Association requesting that a representative of The Institute be appointed to act on the committee which is being formed to consider the standardization of sizes of building brick. The secretary was directed to request J. E. Noulan Cauchon, a.m.e.i.c., to represent The Institute at the meeting of the committee in question held on March 18th, in Ottawa.

The attention of Council was drawn to a circular letter sent out by a Corporate Member of The Institute in which The Institute's name and list of members are made use of for business purposes. The secretary was directed to write to the member in question informing him that reference of this kind to The Institute and Institute membership does not meet with the approval of Council.

Three reinstatements were effected and eight resignations accepted.

The meeting adjourned at 1:35 a.m. until Tuesday, the 22nd of March, at eight o'clock p.m.

Adjourned Meeting March 22nd, 1927.

The adjourned meeting of Council was held at eight p.m. on Tuesday, March 22nd, 1927, President A. R. Decary, m.e.i.c., in the chair, and Vice-President J. H. Hunter, m.e.i.c., and five members of Council being present.

The budget of The Institute for the current year was presented by the chairman of the Finance Committee, and unanimously approved and adopted.

A request was submitted from the Vancouver Branch for permission to inaugurate a "university chapter" or students' branch of The Engineering Institute at the University of British Columbia. Considerable discussion followed, during which reference was made to the report of the Students' Activities Committee presented at the Annual Meeting 1924, and printed in the Journal for February 1924, page 63. The secretary was directed to express Council's gratification at the steps taken to establish a connection with the engineering students at the University of British Columbia, calling attention to the report of the above mentioned committee in 1924, and explaining the procedure to be followed in forming Students' Sections.

The following elections and transfers were effected:—

Elections	
Members	2
Associate Members	10
Affiliate	1
Transfers	
Associate Member to Member	4
Junior to Associate Member	2
Student to Associate Member	3
Student to Junior	4

Twenty-four applications for admission and transfer were scrutinized and classified for the ballot returnable April 22nd, 1927.

Two special cases were considered in connection with applications for admission.

The Council rose at 11:20 p.m.

Engineering Act—British Columbia

An important change in the Engineering Act has recently passed the British Columbia Legislature, and has removed a very real obstacle to the development of the work of the Association of Professional Engineers of British Columbia.

The far-reaching effect of the amendment may be judged by comparing the old and new versions of subsection 4 of section 7 of the Act, which read as follows:—

Old wording:—"Notwithstanding anything to the contrary in this Act, any person may practice without being licensed in the Province for the sole purpose of examining, consulting on, advising on, or reporting on, properties and works in the Province; and such person may, without being licensed, superintend operations directly connected therewith; but such privilege of superintendence shall not be construed as entitling such person to hold himself out as or to generally engage in the practice of professional engineering."

As amended:—"Non-resident consulting engineers may practice in this Province temporarily, provided written notification has been given to the Council of the Association, and provided evidence of satisfactory qualifications shall be submitted if requested by the Council."

In a memorandum regarding this matter, the secretary of the Association points out that it would have been impossible to have obtained this really important amendment at this time unless the members of The Engineering Institute of Canada throughout the province had given it their active support. Moreover, the favourable consideration which has now been granted to the representations of the engineers of British Columbia, after some six years of patience on their part, is in no small measure due to the aid and sympathetic attitude of The Institute's Past President, Major Geo. A. Walkem, m.l.a., m.e.i.c.

The engineers of the province are to be congratulated on the additional measure of recognition which the profession has now received from the Legislature of British Columbia.

Addresses Delivered at the Annual Dinner of the Engineering Institute of Canada, Chateau Frontenac, Quebec, February 16th, 1927

Address of Sir Henry W. Thornton, M.E.I.C., Chairman and President, Canadian National Railways

Mr. President, Your Excellency, Monseigneur, and Gentlemen:—

If I were ever repaid for the laborious hours I spent in the study of calculus and mechanics of materials and various other dry and musty subjects which have enabled me to humbly claim a title as an engineer, I am repaid this evening, and I am happy and proud to find myself this evening amongst brother engineers.

One is always handicapped in speaking after a dinner in the good, hospitable city of Quebec, especially if you have been since two-thirty in the afternoon in this beautiful city. The mind is undoubtedly crowded with thoughts and ideas, but the tongue, for some mysterious reason, seems to be inarticulate and to find difficulty with the sibilant syllables. A journey of a thousand miles for an evening in Quebec is time well spent; there is something about the atmosphere of this delightful city, something about its welcoming arms that brings a glow of happiness and a feeling of contentment.

The profession which all of us are proud to own is an ancient and a respected one. Much has been written and said about it; so much, that I fear it passes my powers of imagination to add anything useful. The engineer has produced all forms of construction from ancient days to modern times; engineers planned all great works of antiquity; theirs are the responsibilities for all of the mighty achievements of men which we find to-day, and they are also responsible for all of those constructive works which are essential for the development of civilization. So that, after all, we may claim as engineers to have accomplished all of those monuments which date from the days of the Pharaohs to modern times. The ancient engineer evolved those fundamental principles of engineering, the inclined plane, the wedge, the lever and all those simple things which, coupled with the inexhaustible supply of labour at substantially no other cost than the expense of conquest, made possible the great engineering works of antiquity. The difference between the ancient and the modern engineer is that the constructionists of the days of Egypt and Babylon had at their disposal unlimited human labour. As time wore on and slavery disappeared and the masses were released from thraldom, the activities and ingenuity of the engineer were bent upon supplanting unlimited labour with mechanical devices, and that marks the distinction between the engineer of olden times and the engineer of modern times.

Our profession is divided, perhaps, into two classes, those who teach and those practice. Every one of us can recall with affectionate memory the days of our colleges and our universities and the tender and esteemed instruction which we had from our engineering masters, and I desire this evening to pay a tribute, in which all of you will join, to those fine instructors, those professors of our profession, who taught us in our earlier days, perhaps reluctantly on our part, who guided our steps and who to-day constitute the genesis of our profession,—our great engineering professors.

Financially, their reward has been poor, but, however that may be, they can think with contentment and with pride upon the devoted services which they have given to the profession of engineering, and I say, Mr. President and Gentlemen, all honour to those fine instructors to whom each and every one of us owe what knowledge we may have of engineering.

Engineering education must necessarily and fundamentally be scientific in most of its aspects, but if I were to make any suggestions or be so bold as to offer any criticism, I should say that a knowledge of the classics and general culture subjects is just as essential to the progress and advancement of the successful engineer as a knowledge of mathematics and stresses in materials or any of those subjects which are ordinarily found in the curriculum of any engineering school. You may say that Latin and Greek may have but little bearing and small utility in the golf-bags of engineering equipment, but I do assure you from practical experience, and from my own knowledge, that an acquaintanceship with general culture subjects eventually becomes of almost major importance to the engineer after he reaches a certain position of prominence in his profession.

I am reminded of this incident: a very famous and well-known bridge engineer once wrote a book on engineering, which he entitled "De Pontibus," which, being done into English, means "Concerning Bridges," as all of you classical scholars will know. This book was distinguished for its excellence and lucidity of expression. A brother engineer once wrote to him and congratulated him upon the title he had selected for his book, whereupon the author in reply said that he had studied Latin for many years and that was the only use he could think of to which he could put it. His friend, thereupon, wrote back and said to him, "All of the fine English which is found in your book is due to your knowledge of Latin," and he was not very far wrong. So that, let our engineering schools and universities by no means overlook the necessity of not only turning out finished engineers from the scientific point of view, but also cultured gentlemen, who understand and appreciate good English.

I remember well the parting words of advice which were given to me by my dear old professor of civil engineering at my university, now dead, but whose memory I shall always revere, who said to me, "I have but one word of advice to give you; if ever, by any chance, you should prove to be a good draughtsman"—and there was small prospect of it,—"never let anyone find it out." There was much wisdom and sagacity in that thought, because just as many brilliant careers have been wrecked on the draughting table as have been wrecked by a permanent wave.

Mr. President and Gentlemen, in the larger sense we are the engineers of a nation; we are building to-day in Canada a nation. I have always maintained that in the construction of any great enterprise, be it a railway or a great industrial establishment, in its initial stages, what is needed are the best brains that money can buy. How many of us have seen in railway construction an example of mistaken location, which lives forever after as an expense and plague to the operating officers? When a railway is being projected is the time to employ the best brains and to pay the highest price to obtain those brains. It is a comparatively simple matter to maintain and operate a railway after it is built, but it is quite a different thing to plunge into a wilderness and to cross mountain chains to locate a railway which will best serve the needs of following generations, and that is the time when the engineer is most needed, so that what we are doing to-day, whether it be in railway construction or in the building up of our nation, are the things which will help or hinder succeeding generations.

In this Dominion of ours,—indeed, one may accurately describe it as a continent, stretching, as it does, from the Atlantic to the Pacific, and from the international boundary to the North Pole,—in all of this great expanse of territory, peopled by individuals of different conceptions of life, with different occupations, there are constantly arising difficult problems which, however sectional they may be in character, have a deep and profound bearing on the future of our Dominion. Upon our manner of dealing with those problems to-day will largely depend the future of our nation, and I take it as a happy thing that there are in the Dominion of Canada so many of those who call themselves engineers, who bring to bear on their engineering problems trained minds, and, in a larger sense, can bring to bear on our national problems minds which have passed through the trial and experience of a college or university education.

The one thing which knowledge teaches more than any other single thing is tolerance, the ability to approach problems from an unprejudiced standpoint, a refusal to become excited over fluttering papers which the wind may blow and a refusal to be distracted from the rational conceptions of things by the rantings of the intolerant critic and by the prejudiced soap-box orator. Those are the things which education brings to us in the building of this nation and in the building of that edifice which we are engaged upon to-day; in that work, let us bring to bear those fine things called poise and tolerance, which builds surely, which builds with accuracy and which lays a foundation upon which our children and our children's children may continue to work that which we have been instrumental in starting.

No country of the world has finer traditions than the Dominion of Canada; the history of no country affords so many examples of fine self-sacrifices, from the early priests of the Church, who came to this country shortly after the discovery of North America by Columbus, who penetrated the wilderness and in spite of tortures by beasts and savages carried the word of God from the Atlantic to the Pacific, down to the day in which our own modern engineers penetrated the Rocky mountains and were responsible for the construction of the two great transportation systems which serve Canada,—all of the engineering achievements constitute fine traditions and fine examples.

We have within the borders of this great country two races. Let us be thankful that we have them, because each one is the complement of the other; each can teach much to the other. Let me compliment, if I may be so bold, the Administrator of this province upon his fine address which was delivered in both French and English; so, I say, that with these splendid traditions, with these fine courageous peoples which inhabit Canada to-day, with all of Canada's natural resources, there is no country which can face with greater confidence, with a brighter outlook for the future, the coming years of this great Dominion.

Mr. President and Gentlemen, I thank you for the privilege of addressing you; I am proud to attend a gathering of brother engineers. We are proud of our profession; we are proud of its achievements; it is for us to see that the traditions of our profession, its ethics and its fine principles are maintained, and I know that all of these things may be safely left in the hands of this Institute of Canadian engineers. I thank you.

Address of Mgr. Camille Roy, M.A., Ph.D., F.R.S.C., Chevalier de la Légion d'Honneur, Rector of Laval University, Quebec

Mr. President and Gentlemen:—

Laval University did not desire to remain indifferent to the very useful work of your convention. The university has lent her assistance to your technical sessions by some of her professors, and this evening, by her Rector, she wishes to congratulate you on those annual meetings at which you exchange your views and your experiences, in order to better contribute to the economical development of our country.

You have chosen Quebec as a suitable place for your congress. Quebec is an ancient and quiet city. She gives to mental labours the assurance of all the necessary tranquillity, and by this tranquillity she favours in a special manner the meditations necessary for the abstract designs of the engineer. Therefore, the engineers are really right at home here in Quebec. I have no doubt that your meeting, held in this atmosphere of peace and light, will be most fruitful.

The science of the engineer is more than ever useful in the development of our national resources, and we admire your zeal in developing them and thus increasing our public wealth.

The universities are the principal seats of the study and progress of science, and our university, with her schools of chemistry, surveying and forest engineering, and with her affiliated school of agriculture, endeavours to serve the best economic interests of this country and to create more and more improved centres of scientific study.

She is thus happy to second your efforts by training in her schools able workers for the advancement of the engineering profession.

It is this desire of co-operation which leads her to wish you, this evening, for your congress in Quebec, the most brilliant success.

Discours prononcé par Monseigneur Camille Roy, M.A., Ph.D., F.R.S.C. Chevalier de la Légion d'Honneur, Recteur de l'Université Laval, Québec

Je vous remercie d'abord d'avoir convié l'Université Laval à votre banquet. Vous lui avez donné, par cette invitation, un témoignage d'estime qu'elle apprécie.

Vous êtes réunis à Québec pour étudier ensemble les ressources naturelles de la province; vous vous appliquez à les bien connaître, afin de mieux faire servir votre science à l'exploitation et à l'utilisation de ces richesses. Notre province ne peut que bénéficier de cette mise en commun de vos études, de votre savoir, de votre expérience.

Et l'Université Laval qui veut contribuer au développement économique de la province, qui a pour mission de former des hommes de science dans tous les domaines de l'activité nationale, ne peut que se réjouir de vos travaux consciencieux, de votre zèle mis au service de nos grands intérêts publics.

Notre pays n'est pas neuf, mais il est réellement jeune. Depuis longtemps déjà nos hommes publics s'efforcent de le mettre en valeur; mais il est incontestable qu'il enferme encore des ressources insoupçonnées, non seulement pour l'agriculture, mais aussi pour le commerce et l'industrie. A mesure que notre activité élargit ses frontières dans notre province, on constate de mieux en mieux qu'elle est appelée à jouer un rôle considérable dans tous les domaines de l'économie.

Dans l'exploitation et l'utilisation des ressources naturelles d'un pays, la science est un facteur de plus en plus efficace. Elle a des moyens d'action, aujourd'hui, qui, sous la main de l'ingénieur, captent les forces de la nature, abolissent les obstacles, concentrent les énergies, et créent de la richesse publique.

L'ingénieur est en train d'écrire l'une des pages les plus importantes de l'histoire économique de notre province, et du Canada. Terres et forêts, mines et pêcheries, colonisation et agriculture, travaux publics de toutes sortes bénéficient de toutes les applications que vous faites de votre science: et voilà que sur toutes les aridités techniques de cette science, vous faites croître et fleurir la prospérité.

Messieurs, les universités qui contribuent à faire la science, à former les savants et en particulier ces grands artisans du progrès que sont les ingénieurs, ne peuvent que se féliciter de contribuer pour leur part à tous les progrès. L'Université Laval ne désire rien tant que d'agrandir en ces domaines économiques sa part d'activité. Ce soir, elle s'empresse surtout de rendre hommage à votre zèle pour perfectionner votre art; elle souhaite vous voir multiplier vos congrès pour multiplier vos bienfaits.

Address of The Hon. Lucien Cannon, Solicitor General of Canada

Mr. President, My Lord Chief Justice, and Members of The Engineering Institute of Canada:—

The Toastmaster, in introducing me, was kind enough to call upon your indulgence by mentioning that I was somewhat a creditor, and that you were indebted to the Government of which I am a member, for having, to some extent, broken the ice during your stay here.

Gentlemen, you have heard Sir Henry Thornton speak, and you will realize how difficult it is to follow a speaker of Sir Henry's experience and eloquence. To add to the difficulties of my task, I have to follow also this evening no less a personage than the Chief Justice of the province of Quebec, before whom in the early days of my active practice at the Bar, I always spoke with a great reluctance, not to say with trepidation.

Sir Henry Thornton, this evening, gave the secret of his successful management of our Canadian National Railways system, when he informed us that he was an engineer. Evidently he has mastered the feat well known to all engineers of having a structural section stand by its own dead weight.

When Mr. Decary was kind enough to tender to me an invitation to attend your banquet this evening, I accepted with pleasure on behalf of the government of Canada and also on behalf of those citizens of Quebec whom you honour by having chosen our city as the locale of your meeting this year. I have no intention of keeping you for any length of time, but may I call attention to the extraordinary features of our old Citadel City, as far as engineering is concerned and insofar as it enables any layman to understand the history of your order and the achievements of your profession?

Within the walls of Quebec we have tokens of the engineering attainments of many generations. If you look at the houses of our city in the older section you will see the workmanship of the French engineers who came here with the first governors, under the guidance of Frontenac and others and with the help of the kings of France. You will see, also, the workmanship of the English engineers who, after the Conquest, came into our country to establish the rules of the British Crown, under which we now enjoy so much freedom and so much liberty. The military walls of Quebec show what the genius of these British engineers could accomplish; and may I broaden this idea to some extent by calling your attention to the very gigantic masterpiece of Canadian engineers by mentioning the great bridge which connects the two shores of the river St. Lawrence? This bridge is a living example of our Canadian initiative and confident boldness; it is also an inducement to every young man who lives within the boundaries of Canada to exert the utmost of his energy to contribute his share in the building up of our country.

To be a real nation, our country must be a self-contained one. Up to very recent years we used to borrow from the neighbouring republic to the south most of the engineers who carried on the great undertakings,—industrial and others,—within the shores of Canada. In 1910, for the first time, the Premier of Canada called upon Canadian engineers to build this great bridge, the greatest of its kind in the world, and Canadian engineers succeeded in doing so.

The Chief Justice and Sir Henry have mentioned the ideals and the objects of the engineering profession. May I ask you to direct your attention for a moment to another angle of your great national usefulness, and that is, in building up our country?

If Confederation to-day is an accomplished fact, if we have throughout our Dominion nine prosperous provinces, competing in sisterly spirit toward the prosperity of Canada as a whole, we owe it to the engineers who have linked these provinces together. The Maritime Provinces never would have joined in Confederation if the Intercolonial Railway had not been built, and the Intercolonial would never have become a railway if we had not had engineers to build it. In the extreme west, in British Columbia, we find the same situation; British Columbia never would have become part of our Confederation if the engineers had not linked British Columbia with central and eastern Canada by the construction of the Canadian Pacific Railway. We owe Confederation to the engineers, and if the pioneers in your profession have achieved these wonderful things in the past, those who listen to me here to-night are also called upon to continue this great work.

The province of Quebec realizes how great may be the industrial expansion of the province if her natural resources are properly developed. We have, at our very gates, the spectacle of the building up of one of the largest industrial plants, in the lake St. John district, which the world has ever known; we have within the gates of our own city immense mills which are being built. Quebec is doing her share; the rest of Canada is also doing its share, and may I say, in conclusion, Gentlemen, that you, who represent every province of this great Dominion, who have come here to confer with other members of your Institute belonging to other provinces, in order to devise the best means and the best methods of promoting the welfare of Canada, will do your share; and your deliberations here this week will, I am sure, bear a fruit that every citizen of Canada will taste with pleasure if you go back to the very ends of our country, to the localities to which you belong, and continue the great work and maintain the great traditions of the organization of which you are members. I thank you.

OBITUARIES

George Alphonso Mountain, M.E.I.C.

One of the most popular, most widely known and highly respected members of the engineering profession in Canada passed away at Ottawa on February 26th in the person of George Alphonso Mountain, M.E.I.C., late chief engineer of the Board of Railway Commissioners. In his passing, Canada loses a man who for many years held one of the most important positions of national responsibility in the Dominion.

The late Mr. Mountain took a leading part in the affairs of The Canadian Society of Civil Engineers, later The Engineering Institute of Canada. One of the first members of the former society, when it came into existence in 1887, he served on its Council in 1893, 1899, 1900 and 1901. He was vice-president in 1903 and 1905, and in 1909 was elected president, a position he filled with great distinction. He was always keenly interested in promoting the welfare of the engineering profession, and his opinions were held in high esteem. The Ottawa Branch honoured him with the chairmanship of the branch in 1913-14, and until his recent illness he was rarely absent from any of the activities of that organization.

Mr. Mountain was born in Quebec City in September 1860. He studied for his profession with the city engineer at Quebec, and in his early engineering work was with survey parties of the Quebec and Lake St. John Railway on engineering work at the Quebec graving docks and on the Newfoundland Railway. In 1881 he joined the staff of the Canada Atlantic Railway. Previous to 1887 he held the position of assistant engineer, in that year being appointed chief engineer, which office he held until in 1904 he accepted the position of chief engineer with the Board of Railway Commissioners. For twenty years he held the latter important post, resigning in November 1924 because of ill health. While he was with the Canada Atlantic Railway, the Ottawa, Arnprior and Parry Sound section of the line was built, and he was also engineer of the Coteau bridge across the St. Lawrence river. For the last two years of his association with the Canada Atlantic Railway, Mr. Mountain was also consulting engineer for the Temiskaming Railway Commission. In 1882 he was commissioned as a Dominion Land Surveyor. In addition to his association with the Engineering Institute, the late Mr. Mountain was connected with various other technical organizations and societies. He was a member of the American Railway Engineers and Maintenance-of-Way associations, and a member of the Royal Astronomical Society of Canada.

In social and sports clubs he was very popular and was a member of the Rideau Club, the Ottawa Hunt and Golf Club and the National Club, Toronto. He took great enjoyment in outdoor sports, particularly in shooting, fishing and golf.

The funeral was held on Tuesday, March 1st, and the long cortege included many citizens prominent in railway circles and the public life of Canada, as well as numerous members of the professional associations in which Mr. Mountain took such a leading part. The Institue was represented by R. J. Durley, M.E.I.C., general secretary, and Noulan Cauchon, A.M.E.I.C., chairman of the Ottawa Branch, as well as by many other members.

Andrew Rainsford Wetmore, M.E.I.C.

In the death of Andrew Rainsford Wetmore, M.E.I.C., who for the past thirty-four years has been provincial bridge engineer for the Department of Public Works of the Province of New Brunswick, the engineering profession has lost one of its prominent members.

Mr. Wetmore had been in ill health for some months, but it was believed that he was rapidly recovering, and his death, following a relapse, came as a great shock to his many friends both within the profession and private life.

The late Mr. Wetmore was born at St. John, N.B., on October 14th, 1862, and received his early education at the high school at Fredericton, finally graduating from the Royal Military College, Kingston, with honours in civil engineering in July 1882.

Following graduation, his first work was in connection with the survey of the Chignecto Marine Railway, on which he was employed in a junior capacity. In January 1883 he became assistant engineer of bridges and buildings for the Montreal and European Short Line Railway along the north shore of Nova Scotia from Pugwash to Pictou. In July of the same year he was appointed junior assistant engineer on bridge construction and railway extension at St. John, N.B.

During the summer of 1884 and until the fall of 1885, Mr. Wetmore was engaged in the relocation and was engineer-in-charge of construction of the Elgin Petitcodiac and Havelock Railway, and in the following year was on preliminary survey of the Short Line Railway from Salisbury to Fredericton, N.B. During the next three years he was with the Canadian Pacific Railway on preliminary and final location surveys between Montreal and Sherbrooke, and was sectional engineer under the chief engineer on the construction of a portion of this line. Subsequently, in 1890, he was engaged in the location of the Quebec Central Railway and in the spring of the following year he was appointed assistant engineer on the double tracking of the Grand Trunk Railway between Port Hope and Toronto. In the fall of the same year he returned to the Quebec Central Railway and was engineer in charge of preliminary and final location survey on the extension from Tring station to Megantic in Quebec. During the winter of 1892-93 he was engineer in charge of surveys of St. John Valley and River du Loup Railway, after which he went to Boston, Mass., where he received private instruction at the Institute of Technology and in the office of a consulting bridge engineer. In the fall of 1893 he was appointed provincial bridge engineer with the Department of Public Works of the province of New Brunswick, which position he held until the time of his death.

The late Mr. Wetmore joined The Institute in 1920, being elected Member on March 23rd of that year.

In the editorial columns of the Telegraph-Journal, St. John, N.B., there appears the following tribute to the late Mr. Wetmore:—

> In the passing of Mr. A. Rainsford Wetmore, chief engineer of the bridge department in the Public Works Department, the province loses a faithful servant whose long service was marked by an unfailing devotion to official duty. For thirty-four years he has

occupied the position of chief engineer, and in that period a complete revolution has taken place in methods of road and bridge building. Mr. Wetmore had valuable experience in his earlier life as a railway engineer, and came to his official duties well equipped. Necessarily, during his long period of service he visited all parts of the province, and made friends among all classes of people who will pay kindly tribute to his memory. There have been many changes of government in New Brunswick since the early 'nineties of the last century, but each succeeding cabinet found Mr. Wetmore competent and entirely trustworthy and retained him in office. He has suffered from ill health for a considerable period, but hope had been entertained that rest and change would restore his vigour. He was a worthy representative of a family distinguished in the public service of New Brunswick, and widespread sympathy goes out to the bereaved family.

Guy Carleton Read, A.M.E.I.C.

It is with regret that we record the death of Guy Carleton Read, A.M.E.I.C., which occurred at his home in Lachine, Que., on February 25th, 1927.

The late Mr. Read was electrical engineer with Messrs. Fred. Thomson Company, Limited, and had been with that firm since 1921. He was born at Kenora, Ont., on July 10th, 1883, and received his early education at the Lindsay Collegiate.

In 1901 he entered the shops of the Canadian General Electric Company, remaining on that work until 1905, when he was appointed assistant engineer for the same company in charge of installation and operation of rotary converters for the Toronto Street Railway Company. From 1907-09 he was assistant to the engineer in charge of installation and operation of substations with the Toronto Electric Light Company. Later he was appointed electrical engineer and superintendent with the Cobalt Light, Power and Water Company, remaining with that company until 1910, when he joined the staff of the Canadian Westinghouse Company as electrical engineer, and during the next six years was in charge of various installations for that company. In 1916 he was with the Shawinigan Water and Power Company in charge of certain electrical installations and in the following year joined the staff of Messrs. J. M. Robertson Limited as assistant engineer until accepting the position which he occupied at the time of his death.

The late Mr. Read joined The Institute in 1925, having been elected an Associate Member on September 15th of that year.

Col. Charles O'Connor Coslette Donnelly, M.E.I.C.

Sincere regret is expressed in recording the death of Col. Charles O'Connor Coslette Donnelly, M.E.I.C., assistant district engineer of the Public Works Department of the province of British Columbia, which occurred at Northfield, Vancouver Island, on December 20th, 1926.

The late Col. Donnelly was born at London, England, on January 1st, 1861, and received his early education in Dublin and London.

In 1886 he was engaged with Edward Jones, consulting engineer, on general engineering works and for the following two years was first assistant to John Maitland Grant, district engineer, Cape Government Railway, and later consulting engineer. From 1888 to 1891 he was engaged in private practice, following which he joined G. H. Poole and Company, Elsburgh Netherlands Government Railway. He was also with a firm of contractors engaged in railway work. For one year he was engineer with H. Douglass and Dupreez on the Klip river section of the Cape Railway, Natal Government Service.

From 1894 to 1901 he was senior district engineer for the Public Works Department, Imperial Government Service. The following three years were spent as senior district engineer for southern districts. On July 1st, 1904, he was appointed government surveyor of works for the Colony, and from then until 1905 he was surveyor of maintenance in addition to the foregoing position. From that date until 1907 he was chief engineer of construction.

In 1910, Col. Donnelly was located at Winnipeg in the government service and subsequently moved to Ottawa, where he was connected with the federal Department of Public Works, remaining there until about two years ago, when he moved to British Columbia.

The late Col. Donnelly served with the British Forces throughout the Boer War and was Colonel with the Canadian Engineers in the Great War, where he gained distinction and was mentioned in despatches.

Col. Donnelly joined The Institute as Member on October 8th, 1910.

St. George James Boswell, M.E.I.C.

The death of St. George James Boswell, M.E.I.C., at his home in Quebec on March 3rd, 1927, marks the passing of one of The Institute's earliest members, and one of the most highly respected citizens of the ancient capital, and the announcement of his death has come as a shock to his many friends.

The late Mr. Boswell was in his seventy-third year at the time of his death, and was consulting engineer of the Quebec Harbour Commission. He was a graduate of McGill University, from which he received the degree of Bachelor of Applied Science in 1874.

He joined the Royal Canadian Engineers regiment in Montreal immediately following graduation, and within a year rose to lieutenant in that unit. From 1875 to 1877 he was connected with the work of building Mount Royal Park, in Montreal, and was subsequently assistant engineer on sewerage and other works in Montreal. In April 1887 he joined the staff of the Quebec Harbour Commission as assistant engineer, being appointed general assistant engineer in 1881 and resident engineer in January 1887. Ten years later he was promoted to chief engineer of the commission.

While still a young man, the late Mr. Boswell's ability as a civil engineer was recognized and he was entrusted with important missions by various governments and private corporations. He was requested by the chief engineer of the federal Department of Public Works to supervise certain work in connection with the port of Halifax, and subsequently he was retained as consulting engineer to the city of St. John, N.B.

His membership in The Institute dates back to the formation of the Canadian Society of Civil Engineers, his election as Member having taken place on January 20th, 1887.

PERSONALS

H. P. Fuller, A.M.E.I.C., assistant engineer, Canadian National Railways, Kamsack, Sask., has moved to The Pas, Man., where he is engaged on the work in connection with the Hudson Bay Railway.

D. W. Hodsdon, A.M.E.I.C., has resigned from his position as engineer, Department of Lands, Water Rights Branch, Victoria, B.C., and has accepted a position with the Canadian Crown Willamette, Limited, Campbell River, B.C.

R. L. Dobbin, M.E.I.C., who has been acting manager of the Peterborough Utilities since the resignation of H. O. Fisk, M.E.I.C., has now been appointed manager. Mr. Dobbin has also been honoured by election as an engineering representative on the senate of Toronto University.

Major G. R. Turner, R.C.E., A.M.E.I.C., has returned from the Staff College at Quetta, India, as he has been appointed district engineer-officer of Military District No. 10, Winnipeg, Man. Major Turner has been in India for the past two years.

J. C. K. Stuart, A.M.E.I.C., of the firm of Stuart and Sinclair, Limited, Hamilton, Ont., was elected president of the Hamilton branch of the Association of Canadian Building and Construction Industries at the annual meeting which was held in the Royal Connaught Hotel on March 3rd, 1927.

Harold M. Thompson, A.M.E.I.C., who, prior to sailing to England last fall, was chief mechanical engineer for Sawyer-Massey Company, Limited, Hamilton, Ont., has joined the engineering staff of John Fowler (Leeds) Company, as designing draughtsman.

H. W. Buzzell, S.E.I.C., who for some time past has been located in Kansas City, Mo., has recently been transferred to Cape Girardean, Mo., where he is engaged as assistant resident engineer on the construction of a highway bridge over the Mississippi river. Mr. Buzzell graduated with the degree of B.Sc. from McGill University in 1924.

H. Davison Hyman, Jr.E.I.C., formerly draughtsman with the Riordon Pulp Corporation, Limited, Temiskaming, Que., has accepted a position with the Spruce Falls Power and Paper Company, at Kapuskasing, Ont. Mr. Hyman graduated with the degree of B.Sc. in civil engineering from McGill University in 1925.

Narcisse J. A. Vermette, A.M.E.I.C., who was previously connected with the Technical Service, city of Montreal, has been appointed city manager for Shawinigan Falls, Que. Mr. Vermette graduated in civil and electrical engineering from Laval University in 1915, and following graduation was employed as chief engineer by the firm of Ouimet and LeSage.

Professor Duff A. Abrams, M.E.I.C., director of the research laboratory of the Portland Cement Association, has resigned, according to an announcement issued by the Association. The work that Professor Abrams has carried out in the field of research in connection with concrete and the bulletins and scientific papers prepared by him are well-known throughout this country. He is a graduate of the University of Illinois, and was for a time a member of the faculty staff of that university.

Edward Hughes, A.M.E.I.C., has been appointed to the engineering staff of the Granby Consolidated Mining, Smelting and Power Company, Limited, and is located at Copper Mountain, B.C. Mr. Hughes was for a time engineer with the Crow's Nest Pass Coal Company, Limited, at Fernie, B.C., as mine surveyor, and later with the Calumet and Hecla Consolidated Copper Company. Subsequently, he was engaged with the Western Chemical Company at Camp Verde, Arizona, and during the latter part of 1926 he was engaged on Canadian Geological survey work in northern British Columbia.

President Decary Receives Honorary Degree

A. R. Decary, M.E.I.C., president of The Institute and superintending engineer of the federal Department of Public Works for the province of Quebec, was the recipient of the Honorary Degree of Doctor of Applied Science, (Docteur ès Sciences Appliquées), which was conferred upon him by the University of Montreal.

Mr. Decary is a distinguished alumnus of the Ecole Polytechnique, Montreal.

D. A. Evans, M.E.I.C., Joins Lake St. John Power and Paper Company

D. A. Evans, M.E.I.C., formerly with the Newfoundland Power and Paper Utilities Corporation, Limited, Corner Brook, Nfld., has joined the staff of the Lake St. John Power and Paper Company, Limited, and is located at Mistassini, Que.

Mr. Evans is a native of Wales, and received his diploma in mechanical engineering from the University of Wales in 1908. His first engineering work in Canada was in the shops of the Grand Trunk Railway at Montreal in 1908. He later became connected with National Transcontinental Railway in the designing department and continued with this organization for a number of years, occupying various positions. He was later with the Canadian Pacific Railway, and subsequently with the Canadian Explosives Limited. In 1915 he was with the Canada Carbide Company, and in February 1917 was appointed manager of the St. Maurice River Boom and Driving Company, which position he held for six years until 1924, when he became associated with the Newfoundland Power and Paper Utilities Corporation.

ANNOUNCEMENT OF MEETINGS

MONTREAL BRANCH

Secretary-Treasurer, C. K. McLeod, A.M.E.I.C.

Apr. 7th: Address on "Recent Development in Aviation," by Mr. Reid.
Apr. 14th: Address on "Manufacture and Uses of Carbon Dioxide," by J. R. Donald, A.M.E.I.C.
Apr. 21st: Address on "Vallee Street Substation," by H. Milliken, A.M.E.I.C.
Apr. 28th: Address on "Gatineau Development," by A. H. White, M.E.I.C.

HAMILTON BRANCH

Secretary-Treasurer, W. F. McLaren, M.E.I.C.

Apr. 22nd: Address on "A Mechanical Transmission Model," by R. C. Bergvall.

VANCOUVER BRANCH

Secretary-Treasurer, F. P. V. Cowley, A.M.E.I.C.

Apr. 6th: Address on "The Engineering Profession and Its Relation to Engineering Education," by E. A. Wheatley, A.M.E.I.C.
Apr. 13th: Address on "Britannia Mines," by C. P. Browning, A.B.
Apr. 20th: Address on "Modern Telephone Practice." Speaker not yet definitely arranged.
Apr. 27th: Open date.

SAULT STE. MARIE BRANCH

Secretary-Treasurer, A. H. Russell, A.M.E.I.C.

April : Address on "Radio," by Mr. B. M. Owen.

ELECTIONS AND TRANSFERS

At the adjourned meeting of Council held on March 22nd, 1927, the following elections and transfers were effected:—

Members

CROPPER, William Charles McDonald, B.Sc., (McGill Univ.), apparatus engr., Northern Electric Co., Montreal, Que.

STIRLING, Grote, private practice in B.C., M.P. for Yale, B.C., Kelowna, B.C.

Associate Members

BUSS, Paul E., plant engr., Provincial Paper Mills, Ltd., Thorold, Ont.

FREELAND, John James, B.Sc., (McGill Univ.), dftsman on paper mill work, Mistassini Power & Paper Co. Ltd., Montreal, Que.

GRAY, Bjarne, M.E., (Kristiania Tekniske Skole), res. engr. i/c mill mtce. and constrn., Kipawa mill, Temiskaming, Que.

HASTINGS, Walter Hindson, B.Sc., (McGill Univ.), engr. to Bureau of Labour and Industries, Sask. Gov't., Regina, Sask.

LOMER, Gerald B., B.Sc., (McGill Univ.), steam engr. with Power Corp. of Canada, Montreal, Que.

PARKS, Ralph E., B.S., (Purdue Univ.), Aluminum Co. of America, design work connected with Arvida Plant, Arvida, Que.

SILCOX, Clifford Henry, asst. engr. survey, Gold Coast Rly.

STEVENS, Robert Herbert, asst. in waterworks office, City of Edmonton, Alta.

VINCENT, Roch Arthur, B.A.Sc., (Laval Univ.), general engrg., architecture, surveying, etc., with Mr. Arthur Vincent, Montreal, Que.

WATSON, Hugh Monroe, Jr., B.Sc., (McGill Univ.), ch. asst. to contracting engr. of Dom. Bridge Co., Montreal, Que.

Affiliate

ANNETT, Fred. A., "Power" editorial staff, New York, N.Y.

Transferred from class of Associate Member to that of Member

BAIRD, Albert Foster, B.Sc., (Univ. of N.B.), prof. of physics and elect'l engrg., Univ. of N.B., Fredericton, N.B.

KOHL, George Hutton, B.Sc., (McGill Univ.), hydraulic engr., Spanish River Pulp & Paper Mills, Ltd., Sault Ste. Marie, Ont.

PRATT, Forest Millen, B.A.Sc., (Univ. of Toronto), ch. engr. i/c plant improvements and mtce., E. B. Eddy Co., Ottawa, Ont.

WEST, Frank Leslie, B.Sc., (McGill Univ.), professor of engrg., Mt. Allison Univ., Sackville, N.B.

Transferred from class of Junior to that of Associate Member

GIFFORD, Francis Darrell, i/c field work on Crow river storage project under Jas. Mackintosh, Midland, Ont.

PERRY, Lewis Alan, asst. engr., Long-Bell Lumber Co., Longview, Wash.

Transferred from class of Student to that of Associate Member

CALDWELL, Charles Edward, B.Sc., (McGill Univ.), time study engr. installing Bedaux System in machine shop, Taylor Instrument Cos., Rochester, N.Y.

GRENZEBACH, Sylvester Leslie, B.A.Sc., (Univ. of Toronto), with Toronto Hydro-Electric System, Toronto, Ont.

HULBURD, William Chauncey, B.Sc. (McGill Univ.), mech. engr. and ch. dftsman, Harland Engrg. Co., Montreal,, Que.

Transferred from class of Student to that of Junior

BLUE, Albert Crawford, B.A.Sc., (Univ. of Toronto), asst. ch. engr., Riley Engrg. & Supply Co. Ltd., Toronto, Ont.

INGS, Jasper H., B.A.Sc., (Univ. of Toronto), res. engr. on Sect. 7 of Kapuskasing-Smokey Falls Ry., Smokey Falls, Ont.

MILLS, Charles Perkins, B.Sc., (McGill Univ.), sales mgr., S. Georgia Power Co., Albany, Ga.

MOULTON, Reginald Heath, B.Sc., (Queen's Univ.), special studies on traffic and cost results, Bell Tel. Co., Montreal, Que.

EMPLOYMENT BUREAU

Situations Wanted

Civil Engineer

Available at thirty days' notice after April 1st. Member of Association of Professional Engineers of Nova Scotia, and licensed Nova Scotia Land Surveyor. Twenty years' experience in eastern, central and western Canada and the United States, including railway location and construction, water power development surveys, construction of dams, factory and office buildings, general steel plant construction, coal mine development, including construction of bankheads, yard tracks, underground systems and mechanical installations. Apply Box 219-W, Engineering Journal.

Mechanical and Construction Engineer

A.M.E.I.C., graduate in mechanical engineering, McGill University '07, with extensive experience in steel and concrete, foundation work, and installation and operation of steam power plant equipment, desires position with consulting engineer or general contractor. Experience also includes the handling of skilled and unskilled labour. Available at once. Apply Box No. 223-W, Engineering Journal.

Civil Engineer

Engineer with a number of years' experience in connection with industrial plants, and particularly in design and construction of pulp and paper mills, wishes to become associated with an engineering or contracting firm or with a pulp company. Speaks both French and English. At present employed. Apply Box No. 224-W, Engineering Journal.

Civil Engineer

Open for an engagement about May 20th, M.E.I.C., returned soldier, twenty-five years' experience in all parts of Canada and United States; railway location and construction, canals, concrete structures, sewers, water systems, buildings, highway location and construction, all classes of pavements; experience as engineer-in-charge and superintendent for contractor. Apply box No. 225-W, Engineering Journal.

Situation Vacant

Structural Designer

Prefer young man, university graduate, with at least two years' experience in structural detailing as well as designing experience with structural steel contractors. State fully, education and experience and when available. Address replies to Dominion Bridge Company, Limited, Winnipeg, Man.

Members' Exchange

For Sale

One Troughton and Simms transit theodolite, on three levelling screws, 6½ inches horizontal circle, 5-inch vertical circle, both graduated to twenty minutes, reading to twenty seconds. Three-inch circular needle, English form tripod; good condition. Also one surveyors' compass, 4-inch needle, 5½-inch sights, 12½ inches apart; all in box, fitted for jacob staff. Can be used on tripod; good condition. Apply to E. T. Wilkie, M.E.I.C., 56 Marmaduke street, Toronto, 3, Ont.

Map of District Northeast of Winnipeg

In the past few years interest has been turned to the region in western Ontario lying north of our transcontinental railway lines, due to mineral activities in such localities as Red lake and the surrounding territory.

Aerial flying in this general region has assumed such importance that it has been considered advisable to issue an "aeronautical map" for the special use of air pilots. This map, known as the Winnipeg district aeronautical map, is printed in colours on the scale of eight miles to an inch and covers an area from Winnipeg to a point about fifty miles east of Kenora, and from the latter place to the point where the Ontario-Manitoba boundary line turns in its course from due north to northeasterly.

The map, although designed particularly for use of aviators, should prove equally serviceable to the general public. It may be obtained from the Topographical Survey, Department of the Interior, Ottawa.

ABSTRACTS OF PAPERS READ BEFORE BRANCHES

The Influence of the Medical Profession on the Education of a Medical Student

W. H. Hill, M.D., D.P.H.

Vancouver Branch, November 3rd, 1926.

In dealing with medical education as a type of successful professional education which might appear to serve as a guide to other professions, particularly to engineering, it will be necessary to speak from the medical standpoint, and to describe the relations which it seems to bear to the engineering standpoint.

Education is that process which elicits those potentialities with which each of us is born, to the number and extent required to make us thoroughly at home in that part of the universe in which we individually may find ourselves.

Now, the very art and science of all living consists in making constantly, daily, hourly, minute by minute, second by second, successful adjustments between ourselves and our surroundings. Our surroundings may be defined broadly as all the things in the universe that affect us in any way. Our surroundings are continuously making demands upon us which we must as continuously meet,—physical, mechanical, chemical, biological, psychological demands; any failure to meet any one of these demands adequately means disaster, disease, even death.

The possession of potentialities for such adjustments constitutes the difference between the living thing and the dead thing. But these *potentialities* must be developed from mere potentialities to actual *abilities* to meet the demands of the surroundings, or the living thing will soon become a dead thing. It is this development of the potentialities which constitutes education.

The demands of everyday life,—physical, mechanical, chemical, biological, psychological,—constitute the most important essential and, in fact, quantitatively, the vast bulk of all education; schools and universities exist merely as development-specialists in small, particular fields, largely psychological.

A university education is a system by which certain demands are collected and marshalled upon us; either those demands for which we ourselves decide to develop potentialities, or, especially in a professional education, those demands which are selected by the wisdom of our predecessors as those which it will be our special province to meet in later life. In the university these demands are made upon us, not haphazardly, irregularly and at great intervals, as in real life, but systematically, progressively, without break in sequence, so that a university education of four years means a training in the meeting of demands, of which in real life no one man would be likely to meet all in forty years; and which he would never have presented to him in systematic, progressive, consecutive order in four hundred years.

The whole art and science of the developing of potentialities lies in so adjusting the demands that each may be met, at first, a little at a time; later with a gradual increase in the degree of the demand; but always with intervals of rest between doses. This graduated dosage is provided in all properly constructed educational courses; and intervals of rest are provided as an essential part of the whole scheme.

It is because the university courses are so laid out as to follow these fundamental rules, biological and psychological, for the development of potentialities, that there can be successfully crowded into them a content of far more than an ordinary life-time will furnish.

This marshalling of demands is the first factor of a university training. Two others are perhaps even more important, and both are inherent in it; the second, included in the first, is that in undergoing intensive development of potentialities, the methods for developing those potentialities are themselves so learned as to be later applied easily, almost automatically, to other potentialities which the university course leaves untouched; and the third, included in the other two, is that the student learns of, not only those demands selected to be made upon him during his course, but of thousands of others also, to deal with neither time nor opportunity exist then, and for which he must later develop his potentialities himself.

To epitomize,—he learns some things; he learns of the existence of many other things; but above all, he learns how to learn. That is to say, this is true of the real student, he who goes to school to learn, not to be taught. One teaches a dog or a horse or a seal; but the real student is not taught,—he learns. The difference is that between a scow and a tug,—between being towed and going under one's own steam.

Cultural education as contrasted with professional education is a preparation to meet a different set of demands, those made artificially, i.e., by man himself, rather than by nature apart from man. Cultural education therefore leads rather to a meeting of the demands of the social organism than to a meeting of the demands of the natural universe, from which the social organism springs. A cultural education, therefore, is of primary value to the individual cultivated, permitting him to fit comfortably into the present social system. A professional education is primarily of value to the race, since it equips the individual thus trained not only to fit into, but to deal with, serve or even modify the underlying foundations of every social system.

But there exists also another important distinction between the cultural and the professional school as we see it in medicine. The distinction arises thus: as already said, the aim of the cultural education in public school, high school and university is, or ought to be, the development of the potentialities of the individual for his own good primarily; to provide him with such a development of his potentialities that he may successfully meet the demands of his human surroundings in after life, that he may be " at home " amongst his fellows in this world. Therefore cultural education is, or ought to be, designed to help, aid and individually encourage and cultivate the individual, to advise and direct him, and so make the most of such capacities as he may have, and especially " to help the lame dog over the stile."

But the professional school in medicine exists primarily to prepare the individual not for his own good, but for the good of the race. Therefore its procedure is not to help the lame dog over the stile, but to erect stiles such that no lame dog can possibly climb them. One object, therefore, of the professional school in medicine is to eliminate, not to patch up or help. For those thus eliminated medicine has no use. Hence it is that the medical professional school of to-day has no cultural aims in the ordinary sense. We realize, of course, that the medical man is an individual with his own life to live; that he needs the cultural features of education for his own benefit, " to make it easy for him to live with himself," as well as the professional features for the benefit of others; and we cannot, if we would, prevent the professional medical training from having incidentally an immense cultural effect. But cultural training *per se* we cannot give; there is no time or energy left for it in the modern medical curriculum, which is quite the most strenuous curriculum on any university campus to-day.

This situation is met by the provision of a required pre-medical course in cultural subjects, and so successfully that the only marked criticism that the author has heard frequently repeated is the lack of training in English composition and in public speaking, particularly the latter. These two things our profession so lacks that the term the " Inarticulate Profession " has been coined for medicine and really quite well fits it. It is interesting to learn that these two lacks are felt in engineering circles also.

Granted all this, then the university education for a profession means no more than an intensification and concentration of cultural education along lines in which it is desirable that the student's potentialities shall be very highly developed, and this for the benefit of the race primarily, and of the individual only secondarily.

Indeed, university education properly considered is far less a matter of preparing a student to meet definitely specified demands than it is a training of the student in how to prepare himself to meet demands not yet definitely specified. In brief, the difference between the man trained only by practice and the university man is, or ought to be, that while the former may be more perfect in meeting the demands of those surroundings that he already knows, the university man is capable of meeting the as yet unknown. The man solely of practice meets the routine well, but is lost completely in the emergency; the university trained man can with practice become just as perfect in routine, but also he can meet and triumph over the emergency as well.

How apply all this to medical and to engineering education? That the applications in actuality shall fall far short of the ideals laid down goes without saying, but how apply them even approximately?

In medicine the demands of humanity have forced the selection of the content of medical education, as indeed is quite right and proper, and as indeed they must. The medical man exists for the patient, not the patient for the medical man. Simple and obvious as this is, it is not always kept steadily in view by every member of the medical profession, but it is certainly the viewpoint of every member of the profession worthy of the name.

Since any patient applying to a physician at any hour of the day or night may present any problem in medicine that has ever been presented, or a problem that has never yet been presented to any physician anywhere, may present that problem in any stage, under any disguise and in any combination with other medical problems, and under any modification of circumstance, such as age, sex, nationality, personal history, etc., every physician, ideally, must be ready at any moment to deal with any application of medicine ever known or to invent new applications, and all as an emergency. Hence, ideally, the graduate in medicine should have all the knowledge of medicine, surgery, nursing, anatomy, physiology, biology, biochemistry, diagnosis, prognosis, therapeutics, etc., at his finger ends, so organized and in such smooth working order that he automatically selects and uses, promptly and well, exactly what is needed to discover what is the matter with his patient and how best to correct it, and all in the shortest possible time. Now, it is absolutely impossible that, in four or even seven years, the university student of medicine should have seen, known at first hand, and become familiar with one-tenth of any one subdivision of his work, even of the main fundamentals of anatomy, physiology, biochemistry, diagnosis and treatment. All that can be hoped is that he will have such a familiarity with the general facts, and more particularly with the general principles, that he will recognize the guiding features of a case presented to him and skilfully and intelligently work out the heretofore to him unfamiliar combinations.

Because then the demands of his patient compel the physician to work out each case in detail, rapidly and usually by himself, at the best with help from consultants, who must themselves see the patient and make their own examinations, the problems of the physician are intensely individualistic and dependent upon his own individual powers.

Others cannot do his work for him; he must know for himself that which he discovers himself with his own eyes, ears and hands. True, his knowledge is pieced out by the extensions of his eyes, (the microscope), of his ears, (the stethoscope), of his hands, (the various registering devices for heart beat, blood pressure, respiration, heat determinations; the thermometer, etc.), and so on, but after all he must know in general what all this evidence put together means, and decide what it means to the particular patient.

Hence exists the sharp-cut outline of medical education. It is inconceivable that a man intending to practice medicine could go part way with his course or even take all of a given portion only. He must graduate in full with a complete training or never join the ranks of the profession at all. In this exists one very definite distinction from engineering to-day. The medical profession necessarily consists of an aggregation of individual champions, while engineering consists rather of an army of all grades, from private to general. Again, valuable as the earlier years of medicine might be culturally to any citizen, the pace is too hard, the requirements too high, and the cultural returns too small, (in the estimation of the average student), for the game to be worth the candle, culturally; and there is no profession, no work other than medicine, for which the earlier years of the medical course fit a man. Once entered upon medicine he must finish or take up something else. It appears that this is not equally true of the engineering course, so that a man having had one year in engineering is equipped for certain industrial demands; after two years he has a wider field open to him; after three years he is still more useful, and so on. Even after he graduates in engineering he may never practice engineering, yet find his course invaluable to him in other lines.

To provide a body of men in engineering that shall approximate to the body of men who constitute the profession of medicine, it will be necessary, as a minimum, to differentiate, as in medicine, between those trained to meet emergencies in every field of the profession and those whose training is such that they are merely auxiliaries in special fields. You must differentiate between your physicians and surgeons on the one hand, and your nurses, laboratory technicians and orderlies on the other; you must distinguish between your university man of training in all branches of engineering and your technician who is expert only in one part of one branch.

It must be said that the development of medicine as a profession, for reasons quite obviously involved in the demands of the human race already outlined, is of very ancient date. *Esprit de corps*, dependent on the need for protection in dangerous, difficult, responsible decisions, that must usually be made quickly, individually, and which often involve life and death, set apart the physician, very early in history, as a distinct entity. He was in early days almost the only man of his community supposed to be learned in the sciences generally, and quite the only man who was supposed to know anything at all at first hand of human anatomy or physiology. Much of these subjects he learned by the study of human bodies stolen from the cemetery or of animals experimented on in remote or concealed places, often at the risk of his own life from ignorant, superstitious neighbours, who expected him to know all these things perfectly, but strenuously objected to the only method by which he could possibly learn them.

This situation also lent itself to driving the members of the profession into a single, almost fraternal, union. True, these early days have passed, but the traditions remain, and there is to-day no "Freemasonry" in any craft more close than that of medicine. In this respect engineering is much more like the army than like medicine; and, if I mistake not, the engineer of early days rose into prominence without persecution and on account of important public military demands, rather than on account of individual private civil demands.

On the other hand, while medical opinion and medical ethics have greatly controlled the admission of men to the profession and the standards that each member must reach practically and ethically, the medical profession as such has had a very small part in the direct development of the medical curriculum. Rather has the university education made the profession what it is today than the converse.

True, individual great medical leaders and medical teachers have arisen who have carried out research and have taught students new things or in new and striking ways. The earlier schools of medicine each centred on some such one great man as a rule. But it is the universities who gave these men their opportunities and who have adopted and developed the content and methods of such teachings—not the medical profession which has formally demanded these developments of the universities.

Of course, the great leaders, and especially the great teachers in medicine, have generally been in very close touch with the rest of the profession, which latter therefore has had the opportunity to exercise what Dr. J. M. Pearson calls a "silent pressure" on medical education,—a pressure applied indirectly and individually rather than directly and as a body. One thing which gives to the leaders of the profession these very opportunities in leadership to-day is the practice of securing outstanding practising physicians and surgeons as lecturers and clinical (hospital) teachers. The pure sciences can nowadays only be taught by the specialists, who alone are able to devote their whole time each to his own line; anatomy, physiology, bacteriology, physics, biology, chemistry, could not now be taught as they once were, not so long ago, by practising physicians. Equally impossible would it be for such specialists to teach the practical bedside handling of the actual patient.

The university, in co-operation with and guided by outstanding members of the medical profession, is the real power behind the medical curriculum, especially the scientific side. The practical branches are almost wholly conducted under university control by practising physicians. (Even here whole time university professors not in practice have been recently experimented with at a number of universities, although the results are still in doubt.)

The medical profession as such has had little effect on the medical curriculum to-day, but much upon the selection and general development of the student, particularly upon the elimination of the unfit.

Practice is merely the carrying out in daily life of principles established by long, patient research. If the principles of engineering education can be established broadly and firmly, the adjustment of the practice of engineering education to them should not be difficult. Agreement as to these principles is obviously an essential preliminary to the formulation of any concrete plan.

Petroleum

Dr. Bruce Rose, Geology Department, Queen's University.
Kingston Branch, February 1st, 1927.

In his opening remarks Dr. Rose said that the world production of petroleum in 1857 was 2,000 barrels, all of which came from Russia. Today world production is over 1,000,000,000 barrels per year, and approximately two-thirds of this comes from the United States.

Industrial development has kept pace with increasing oil production, and is indeed so largely dependent on it in its three chief uses,—for internal combustion engines, for fuel, and for lubricants,—that it behooves us to enquire if there be a danger of a failure of supply. Up to date the finding of oil has kept pace with the demand, but eventually, as the known fields become exhausted, there will be a falling-off in the supply of liquid petroleum, (that which we ordinarily think of as coming from flowing or pump wells). A few years ago it was estimated that the supply would last less than twenty years, but new fields are being found from time to time, and the estimate of future supply is correspondingly increased.

United States, the most thoroughly prospected country, has been brought to the point of producing two-thirds of the present world supply. Within the last year Columbia has become a big producer. No doubt, as other parts of the world are more thoroughly prospected, new fields will be found, and the time for world exhaustion will be postponed.

Those most competent to judge the situation say that the supply will last for at least fifty years, and probably much longer, for the potential reserve is being constantly increased by the bringing into production of new fields, by better recovery methods, by deeper drilling with the consequent tapping of hitherto unavailable reservoirs, and by better methods of distillation giving higher recovery of the light oils from the crudes. However, the liquid supply is limited; and, although there is no danger of failure of supply in the near future, the hope is that, by the time it begins to fail, new and commercial methods for extracting oils from shales, from bituminous sands, and from coals, will be perfected. The opinion seems to be that science and invention will thus take care of the future.

In Canada upwards of 20,000,000 barrels per year are consumed, and less than 500,000 barrels produced. The official figures for 1925 are 318,253 barrels. However, the production is increasing rapidly with the development of new wells in the Turner valley field in Alberta within the last two years, and particularly within the last few weeks, and may pass the half million mark this year.

The chances of finding new fields in Canada are confined largely to the flat-lying, or gently folded rocks of Ontario and the great plains, particularly of Alberta. Ontario production reached its peak at the beginning of the present century, and is likely to decrease gradually, although with new and better recovery methods Ontario will continue to produce for a long while.

The best possibilities for finding oil in Alberta are in the most easterly pronounced folds of the foothills region, east of the faulted area, and west of the more flat-lying rocks of the great plains. It is from one of the structures that the Turner valley production comes. There are many similar structures along the foothills from Montana to the Yukon. Many of these are not prospected. The success of Turner valley leads to the hope that other fields will be equally productive.

The finding of small amounts of oil farther east in Alberta, in the more flat-lying rocks at a number of points, holds forth the hope that, with more extensive study of the structures, and with the later improved methods of oil finding, many pools may be found, not only in eastern Alberta but also in Saskatchewan and Manitoba, where similar geological conditions occur.

The most significant thing with regard to oil possibilities in Alberta is that the new fields are in Paleozoic rocks Until two years ago the production was all from lower Cretaceous horizons. Then, with the deeper drilling of Royalite No. 4 well into the underlying Paleozoic rocks, a flow of over 500 barrels was obtained. This well continues to produce at this rate, and the development of the last few weeks records a number of wells coming in from this new horizon. It is consequently very likely that many more wells will be drilled to this horizon, not only in Turner valley but in other similar structures, with the hope of like success.

The find at Fort Norman, within the Arctic circle, has proved to be not nearly so important as at first thought, but is significant in that similar occurrences may be found in many places in the vast north. It indicates that there may be worthwhile areas which will be utilized in the future if failure in more available regions makes it economically advisable to exploit them.

There is an increasing supply of oil coming from Alberta and, although it is not safe to make any predictions as to what this may eventually reach, it is to be hoped that the success in Turner valley may be duplicated at other points.

The recovery of oil from shales, bituminous sands, and coal may present the hope of the future. Here Canada has tremendous possibilities. There are shales in unlimited amounts in all the provinces of the Dominion. Little is known of their potentialities as oil producers, except at a few points where they have been tested. The best known areas are in New Brunswick near Moncton, where recoveries of from twenty to thirty and more gallons per ton have been made. The fact that these are being actively prospected and tested in commercial plants is the best evidence of their practical and commercial possibilities.

As regards bituminous sands, there are in Alberta, in the vicinity of McMurray, outcrops of the so-called "tar sands." Here, along the Athabasca and Clearwater rivers for a number of miles, a thickness of approximately 75 feet of bed-rock consists of a sandstone, the cementing material of which is largely a thick bitumen. A cubic yard of this rock yields, on distillation, about thirty gallons of oil. Conservative estimates of the extent of these sands available place the area at twenty thousand square miles. A slight calculation will show that there is here tremendous potential oil supply. Up to date the mechanical and physical difficulties of extracting this oil from the sands on a commercial basis have not been overcome, but doubtless an economical and practical method for the recovery of the oil will eventually be found.

As regards coal as a source of oil, it is well known that the high volatile coals will yield on distillation a considerable percentage of oil. In Canada there is bituminous and lignite coal equal to more than one-eighth of the world's supply. There is, therefore, no lack of coal if the time should come when the oil supply must depend on such a source.

Canada imports most of her liquid petroleum and will continue to do so unless the fondest hopes are realized and large oil reservoirs are discovered in the great plains area. As long as oil from wells is available at anything like the present prices, Canada is likely to depend largely on such a source; but it is comforting to know that when it begins to fail, as it will in the not distant future, Canada still has vast potential reserves in her shales, coals and bituminous sands.

BOOK REVIEWS

Solving Sewage Problems

By George W. Fuller, M.E.I.C., and James R. McClintock. McGraw-Hill Book Company, New York, 1926. Cloth, 6 x 9 in., 548 pp., illus., tables, $6.00 net.

"Solving Sewage Problems" seems to fill a hitherto vacant gap in the literature of sewage disposal. Written in a style sufficiently simple to be easily understood by the non-technical reader, it is thorough in its treatment of the matters it discusses. Few engineering readers, though experienced in sewage disposal, will lay this book down without feeling that something has been added to their knowledge, particularly on the more recent processes.

Fourteen chapters, comprising 180 pages, are devoted to fundamental considerations,—an outline of the problems, legal, legislative and administrative, oxygen and biological balances, etc. The remaining 350 pages are given over to a discussion of the basic factors governing the choice of disposal methods, the design of the necessary works and operating data.

Especially to be noted is the emphasis placed on the newer sewage disposal methods and apparatus. Among these may be mentioned the use of skimming tanks, separate sludge digestion, gas collectors and utilization, electrolytic processes, fish pond treatment and the activated sludge process. This last, as befits its importance, is discussed from the standpoints of theory, design of plant, disposal of sludge and its fertilizing value.

The book closes with a non-technical summary, one of its most valuable features, and two appendices, one on waste control procedure and the other on the treatment of phenol wastes.

If city officials could be induced to read "Solving Sewage Problems," they might perhaps gain some understanding of the numerous and complicated problems their engineers must face,—and solve. Engineers will find in it numerous data not elsewhere available in English.

R. deL. French, M.E.I.C.

Waterworks Handbook

By Alfred D. Flinn, Robert Spurr Weston, M.E.I.C., and Clinton L. Bogert. Third Edition. McGraw-Hill Book Company, New York, 1927. Cloth, 6 x 9 in., 871 pp., diagrams, tables, $7.00 net.

The third edition of the "Waterworks Handbook" is as detailed as "Solving Sewage Problems" is general. In the ten years which have elapsed since the appearance of the original edition, waterworks practice has progressed and new data have become available, both of which facts are duly recognized by this new edition.

In 850 pages, divided into six parts and 38 chapters, the authors have contrived to compress information which must have occupied many times that space in its original form, and to do this without impairing its value. The art of skilful digestion has been brought to a high pitch of perfection in this handbook.

Whenever practicable, tabular and graphical presentation of data makes reference quick and easy. A humorous touch here and there,—for example, in figure 250,—serves to emphasize points and to relieve the monotony, thereby making effective cautions which have been preached to waterworks men for so many years that they have long lost most of their original effectiveness, though perhaps they are even now more necessary than formerly. A very complete bibliography follows each chapter, and a complete system of indexing textual references adds greatly to the book's value.

It is useless to itemize the contents in this short review,—something regarding practically everything of which the waterworks engineer may be in search may be found, the gist of it extracted and served with useful comment, and the source referred to. This is the function of any "handbook," and this one fulfils its function excellently well.

Let us hope that in another decade we may have another edition, revised and brought up to date, and that the "Waterworks Handbook" may attain service as perennial as Kent, Trautwine or our other engineering standbys.

R. deL. French, M.E.I.C.

Diesel Engines

By Arthur H. Goldingham. Third Edition. E. and F. N. Spon, Limited, London, 1927. Cloth, 6 x 9 in., 249 pp., 197 illus., 21/- net.

The new edition of this well-known book has been largely rewritten and will be found of value to any engineer engaged on the purchase, design or operation of Diésel engines. Its utility to the student of the subject is increased by the excellent sectional and photographic illustrations of the latest types of two- and four-cycle, single- and double-acting Diesel engines, showing not only general arrangements but also many important details of design. The advantages and disadvantages of various types are classified and compared, and this will aid the engineer or owner in forming an opinion as to the particular type best fitted for his special needs. Testing and operation are dealt with in some detail, and, as an introductory chapter, a brief résumé of the first principles and theory of internal combustion engines is given.

The author correctly points out that the present reliable and economical Diesel engine has been developed by investigation and close co-operation between the metallurgist and the mechanical engineer. The many practical problems in connection with fuel injection, ignition, starting, cylinder and piston cooling and lubrication in Diesel engines have all required prolonged experiment for their solution, and the results are well set forth.

The book can be recommended as a clear and comprehensive work on an important subject.

Aerial Cableways

By G. Ceretti, translated by Wm. J. Walker. E. and F. N. Spon, Limited, London, 1927. Cloth, 4 x 6½ in., 110 pp., diagrams, tables, 5/ net.

The work of an Italian engineer with long experience in the construction of aerial cableways, this book is based on his notes, and deals briefly with the design calculations for the various component parts of such installations. The utility of the book for the engineer interested in the general design and layout of cableways would have been increased by including a chapter treating of supporting towers, as comparatively little reference is made to these structures. It will, however, prove of substantial use to constructors of aerial cableways and those who are already familiar with the arrangement of wire rope transporters and desire to decide the outline of a proposed installation or verify the calculations for its design.

Concrete Designers' Manual

By George A. Hool and Charles S. Whitney. New Second Edition. McGraw-Hill Book Co., Inc., New York, 1926. Cloth, 6 x 9 in., 328 pp., diagrams, tables; $4.00.

The second edition of this manual has been revised and new sections have been added so as to include material useful to the engineer engaged largely in the design of reinforced concrete structures. The book is in no sense a treatise on the principles of design, but is a collection of tables and diagrams for the rapid design of reinforced structures by those familiar with the use of such diagrams. The formulae which the diagrams and tables represent are quoted, and examples of the uses of the diagrams are given where necessary. A large field of practice is covered in this way, including ordinary beams and slabs, T-beams, flat slabs, shear reinforcement, columns, bending and direct stress, footings and symmetrical arches. At the end of the book there is a collection of miscellaneous information, such as approximate quantities for rough estimating purposes; weights of building materials and contents of warehouses; tables showing the dimensions and reinforcement required for retaining walls under various loading conditions; shear and moment coefficients and influence lines for continuous beams. The specification of the Joint Committee for Concrete and Reinforced Concrete, (1924), and the Building Codes of New York and Chicago are also included.

The authors are careful, and rightly so, to state that final designs for structures, such as flat slabs and arches, should be worked out in every case by an experienced engineer. Thus in Section 10, dealing with symmetrical arches, and containing the data published by one of the authors, Mr. Whitney, in the Transactions of the American Society of Civil Engineers, Vol. LXXXVIII, the following sentence occurs:—"It is not the intention of the authors to present these data for use by designers not familiar with the general theory of elasticity and its limitations as applied to concrete arches, but, in the hands of an experienced designer, the method given in this section should effect economy in both design and construction of arches." This is a proper attitude, and the remarks are obviously applicable in some measure to all sections of such a book.

In many cases diagrams and tables have been added or revised to include the requirements of the 1924 Report of the Joint Committee, but in the case of flat slabs tables are given covering the recommendations of the American Concrete Institute, and of the Building Codes of New York and Chicago. The authors refer to these as being sufficiently like the requirements of the 1924 Joint Committee Report to enable preliminary designs to be made under the latter code. This is probably quite true, and is in harmony with the recommendation referred to above, that the tables be used for preliminary designs leading to the preparation of final designs by an experienced engineer.

Formulae for reinforced concrete columns threaten to become as numerous as formulae for steel columns, but the authors are not responsible for this, and tables covering many different specifications are provided.

Naturally, the reviewer has not *read* this book, but in glancing over the notation and formulae given at the beginning of the book, he noted that the formula for inclined web reinforcement is wrongly quoted in two places on page 4. The correct formula is given in section 127 of the 1924 Joint Committee Report at the end of the book. The error is of little consequence, as this is not a book of formulae to be worked out, but rather a book of tables and diagrams to enable people to avoid arithmetical work.

The tables and diagrams are on the whole well arranged, and those whose duty it is to work largely in one field of engineering design will find them useful.

E. Brown, M.E.I.C.

Standardization of Brick Sizes

Under the auspices of the Canadian Engineering Standards Association a conference on standardization of brick sizes was held in the board room of the National Research Council in Ottawa on March 18th, 1927.

The different interests were represented as follows:—J. E. Noulan Cauchon, A.M.E.I.C., Engineering Institute of Canada; E. L. Horwood, Ontario Association of Architects; B. Stuart McKenzie, M.E.I.C., secretary, Canadian Engineering Standards Association; Howells Frechette, Ceramics Division, Department of Mines; J. F. Meagher and J. Clark Reilly, Association of Canadian Building and Construction Industries; J. F. B. McFarren, D. C. Markley and G. C. Keith, Canadian National Clay Products Association; F. W. Jackson, Bricklayers, Masons and Plasterers International Union; A. U. Cote, Tile Manufacturers Association.

The question of standardizing on brick sizes is one that has been occupying the attention of Canadian manufacturing and construction interests for some years, and various attempts have been made to come to an understanding. The most active organization has been the Canadian National Clay Products Association, and at their convention, held in Toronto in February this year, a formal resolution was passed standardizing on the following sizes:—

Common brick, 8 x 2¼ x 3¾
Rough face brick, 8 x 2¼ x 3¾
Smooth face brick, 8 x 2¼ x 3⅞

These sizes have already been recommended by the Division of Simplified Practice in the United States, and generally accepted by construction interests.

Following the resolution above mentioned, the Canadian Engineering Standards Association was requested by the Clay Products Association to take action in the matter.

After a thorough discussion of the situation, in which all present took part, it was resolved that the sizes of brick specified above be adopted, and that manufacturers take immediate steps to manufacture on this basis. The resolution was unanimously carried, and nominations, subject to the approval of the interests represented, for a committee of the Canadian Engineering Standards Association were received. When this committee has been regularly constituted it will arrange for the preparation of a specification.

New Map of Northwestern Canada

In a new map just issued by the Topographical Survey, Department of the Interior, the great district comprising northern portions of Alberta and British Columbia, Yukon Territory and Mackenzie district, are shown with the most complete information available. The topography is corrected to the latest surveys and all data relating to settlements, trading posts, missions, and other activities are included.

The map is on a scale of fifty miles to the inch and is twenty-four inches by thirty-four inches in size.

Recent Additions to the Library

Proceedings, Transactions, Etc.

Presented by the Societies:
Proceedings of the Society for the Promotion of Engineering Education, vol. 33, 1926.
Proceedings of the National Council of State Boards of Engineering Examiners, seventh annual convention, 1926.
Proceedings of the Institution of Engineers and Shipbuilders in Scotland, vol. 69, 1925-26.
Journal and Record of Transactions of the Junior Institution of Engineers, vol. 36, 1925-26.
List of members of the Institution of Civil Engineers, 1927.

Reports, Etc.

Presented by Chemical Abstracts:
List of Periodicals Abstracted by the Chemical Abstracts with Key to Library Files, 1926.

Presented by the Technical Association of the Pulp and Paper Industry:
Technical Association Special Report No. 1, Manufacturing Problems Handled under the Service-to-Members Plan, December 1926.

Presented by the Department of the Interior, Canada:
Canada as a National Property, 1926.

Presented by the Commissioner of Public Works, Boston, Mass.:
Annual Report, 1926.

Preented by the Dominion Bureau of Statistics:
Statistics of Steam Railways of Canada, 1925.

Presented by the Smithsonian Institution:
Annual Report, 1925.

Presented by the University of Missouri, School of Mines and Metallurgy:
Mechanical Underground Loading in Metal Mines, by Charles Van Barneveld.

Presented by the Quebec Department of Roads:
Report, 1926.

Presented by the British Columbia Commissioner of Public Works:
Report, 1925-26.

Presented by the Department of Labour, Canada:
Report, ending March 31st, 1926.

Presented by the Authors:
Reinforced Concrete Poles, by P. Gillespie, M.E.I.C., and F. E. Wilson, (University of Toronto, Faculty of Applied Science and Engineering, School of Engineering. Bulletin 6, Section 2).

Presented by the United States Geological Survey:
Annual Report, 1926.
Bulletin 788, Topographic Instructions of the U.S.G.S., by E. M. Douglas.
Bulletin 784, Bibliography of North American Geology for 1923-24, by J. M. Nickles.
Water Supply Papers, 553, 554, 559, 565, 580B.

Presented by the United States Bureau of Mines:
Tech. Paper 370, The Bowie-Gavin Process, by C. P. Bowie.
Tech. Paper 408, Coke Oven Accidents in the United States, 1925, by W. W. Adams.
Tech. Paper 406, Production of Explosives in the United States, 1925, by W. W. Adams.
Mineral Resources of the United States, Parts of Pt. 1-11, 1925.

Presented by the United States Bureau of Standards:
Misc. Publications, No. 74, Nineteenth National Conference on Weights and Measures. Cir. 17, Magnetic Testing.

Presented by the United States Department of Commerce:
Elimination of Waste. Simplified Practice. No. 12, Hollow Building Tile, rev., 1926. No. 53, Steel Spiral Rods.

Presented by the Canadian Geological Surveys:
Memoirs No. 149. Placer and Vein Gold Deposits of Barkerville, B.C., by W. A. Johnson and W. L. Uglow.
Memoir 150. Whitehorse District, Yukon, by W. E. Cockfield and A. H. Bell.
Economic Geology Series No. 2, Talc. Deposits of Canada, by M. E. Wilson.

Presented by the Department of Mines, Canada:
Annual Report, 1926.

Presented by the Department of Labour, Canada:
Prices in Canada and Other Countries, 1926.
Wages and Hours of Labour in Canada, 1920-1926.

Technical Books

Presented by Gauthier-Villars et cie:
Art de l'ingenieur et metallurgie, by L. Descroix, (Annual Tables of Constants and Numerical Data, Chemical, Physical and Technical).

Presented by E. & F. N. Spon:
An Introduction to Metal Work, by T. R. Parsons.

Presented by the Canadian Manufacturers' Association:
Canadian Trade Index, 1927.

Presented by Williams and Wilkins, Baltimore:
Interpolation, by J. F. Steffensen.

Trade Publications

The Canadian Ingersoll-Rand Company, Limited, have for distribution to those interested two handbooks entitled "Modern Central Stations." These handbooks consist of a collection of reprints of articles describing central stations, which articles have appeared from time to time in leading technical journals. The booklets are bound in loose-leaf form, convenient for fyling, and provide an excellent ready reference of published data on modern fuel power stations. To date, the company has issued the first and second sections of this compilation, and it is their intention to reprint and make available for distribution future articles of the same nature. Copies may be secured from The Canadian Ingersoll-Rand Company, Limited, 260 St. James Street, Montreal, Que.

The Dominion Oxygen Company, Limited, have issued a comprehensive text-book on welding and cutting by the oxy-acetylene process, entitled "Oxwelder's Manual."

The book comprises 216 pages, profusely illustrated. It includes tables of data on welding and cutting and a complete index. The thorough and practical manner in which the subject is treated is indicated by a survey of the contents:—

Historical Development of Oxy-Acetylene Welding; Oxygen and Acetylene; The Process of Oxy-Acetylene Welding and Cutting; Equipment for Welding and Cutting, Blowpipes—Construction and Operation; Regulators—Construction and Operation; Welding and Cutting Accessories; Cutting; Welding Cast Steel; Welding Practices for Cast Iron; Welding Large Gray Iron Castings; Bronze-Welding of Cast Iron and Malleable Iron; Welding Brass and Bronze; Welding Monel Sheet and Castings; Welding Sheet Aluminum; Welding Cast Aluminum, High Carbon Steel and Alloy Steels; Welding Copper; Stelliting; Cutting Heavy Steel Sections and Heavy Cast Iron Sections; Precautions and Safe Practices; Shop Layout and Organization.

This new book is taking the place of the former publication "Oxwelding and Cutting," which ran through eight editions, and although this is marked the ninth edition it is apparent that the publishers have started from the ground and built up an entirely new manual.

Copies of the manual can be secured by addressing the Dominion Oxygen Company, Limited, 92 Adelaide Street West, Toronto, Ont.

Canadian Government Ice Breaker "Mikula" Leaving the Wharf at Quebec for Trip to the Quebec Bridge on Occasion of the Annual General Meeting of The Institute, February 16th, 1927.

BRANCH NEWS

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

Forest Conservation and Timber Preservation

On February 17th, A. S. Dawson, M.E.I.C., gave an address on "Forest Conservation and Timber Preservation," which was listened to with great interest by a large number of members and friends. Mr. Dawson's paper was of a most exhaustive and comprehensive nature, containing a fund of useful knowledge and statistics that, when published, will form a valuable asset to anyone's library. The information gathered and compiled from so many sources and put into such shape must prove of considerable use to all interested. Many excellent slides were shown in connection with the treatment of timber and the condition of timber in use. J. H. Ross, A.M.E.I.C., was chairman, and J. S. Tempest, M.E.I.C., moved a cordial vote of thanks to Mr. Dawson.

Development of the Art of Communication

On March 3rd, Mr. A. M. Mitchell, auditor of the Alberta Government Telephones at Edmonton, gave an address before the branch on the "Development of the Art of Communication." Commencing with a description of the earliest forms of communication, Mr. Mitchell outlined these in chronological sequence in a decidedly interesting manner. He related how communication between man and man had existed in some shape or form throughout the centuries, the earliest of which was probably by burning beacons. Then he recounted how coloured sails were used by the Greeks in marine signalling and how Marathon ran 140 miles in two days to carry the news of victory; also how the early Gauls employed sentinels to shout the message one to another. It was interesting to learn that the forerunner of our modern heliograph was the sunlight flashed from a polished Roman shield, these same people using flags and various forms of light flashes to signify letters of the alphabet. Then we come to the Indian smoke signals controlled by blankets over a smoke fire, and the shooting into the air of flaming arrows. In Africa the drum was used as a means of transmitting messages by sound. A peculiar method related by the speaker as a news medium was the method adopted by the southern darky slaves in the civil war in the United States, who cleverly wove important news of battles from the northern armies into their folk-songs. Then followed the more advanced flag signalling at sea and the semaphore originally used by Napoleon in Europe.

Mr. Mitchell spoke of the first germ of the telegraph being sown in a Scottish magazine in 1855 by an unknown writer whose initials were "C. M.", probably Charles Morrison. This inventor adopted, in theory at least, the principles of the magnetic or static influence of glass friction rods on small bits of paper. Then followed the battery which somewhat revolutionized matters. Then Ampere discovered the magnetic deflecting influence of a coil of wire on the needle, and in 1837 Charles Wheatstone invented the first practical telegraph adapting the combination of a needle and a loop of wire. In 1841 the telegraph instrument was first on public exhibition and about this time the Great Western Railway installed thirteen miles of telegraph line.

In 1868 Wheatstone was knighted for his invention. Then followed Samuel Morse, from whom, in conjunction with one named Watson, we obtained the Morse code used today. Much success was attained in the United States in 1845 in connection with improvements in telegraph transmission. In 1850 the English channel cable was successfully laid and installed for communication. Then followed four unsuccessful attempts to cross the Atlantic ocean, which was finally achieved on the voyage of the steamship Great Eastern.

The speaker then told of the wonders of the telephone. How in 1876 Alexander Graham Bell invented the first successful telephone, and how during the next twenty-five years feverish experimentation took place, and also that, from 1900 to 1925, development of extraordinary rapidity was evident. In 1888 as many as one hundred wires were enclosed in one cable, but today we find that one cable can accommodate as many as 2,440 wires. In 1915, one of the greatest achievements took place when Bell sat in New York and telephoned to San Francisco, a distance of 3,400 miles.

Many excellent slides were shown on the screen, kindly manipulated by Mr. J. D. Baker, plant superintendent at Edmonton. These showed many phases of telephonic and telegraphic communication, and also in chematic form the principle of picture transmission by wireless. This latter was clearly outlined by the speaker in a purposely non-technical way and, being the very latest thing in wireless science, was of particular interest to the audience. Pictures of many ancient and modern telephone exchanges and instruments were shown, also one of the "weavers of speed," as he happily termed the modern girl operator seated at the switchboard amidst many wires.

Referring further to the telephone, he named the three types in use, namely: the magneto type, the common battery type, and the automatic type used in Calgary. He extended a pressing invitation to all to visit the automatic exchanges in Calgary, and especially to see the new "repeater" which has made it possible for Albertans to talk to practically all points on this continent. These repeaters are necessary at intervals along the lines to amplify the voice sounds, and are similar in form to the tubes used in radio engineering. Mr. Mitchell was quite optimistic over the possibility of being able to talk to England from Alberta in the not very distant future.

He mentioned the wireless inventions of Marconi in 1897, when experiments were successfully carried out across the English channel, and also what radio enthusiasts owe to De Forrest for his experiments in 1905.

At the conclusion of the address, T. Schulte, A.M.E.I.C., moved a very hearty vote of thanks to the speaker and, on behalf of the branch and Chairman J. H. Ross, A.M.E.I.C., extended many thanks for one of the most pleasant and instructive evenings the branch has spent this season.

Record Oil Production

The Royalite No. 4 well, situated in the centre of Turner valley, about forty miles south of Calgary, produced approximately 18,700 barrels of 72 gravity natural gasoline during January, which is a new monthly record. Instead of a decreased flow, as might be expected, this well has shown a steady increase as demonstrated by the following figures:—

November, 1926—15,563 barrels
December, 1926—18,447 "
January, 1927—18,703 "

This well has been flowing steadily since October, 1924, and in 1926 production exceeded that of 1925 by 30,000 barrels. The total for 1925 was 167,722 barrels and for 1926 approximately 200,000 barrels of naphtha.

Halifax Branch

K. L. Dawson, A.M.E.I.C., Secretary-Treasurer.

At a meeting of the Halifax Branch, held at the Green Lantern on March 4th, the following papers were read by members of the staff of the Nova Scotia Highways Board:—

"Highway Bridges," by J. E. Belliveau, A.M.E.I.C.
"Construction of Gravel and Crushed Stone Roads," by A. B. Blanchard, M.E.I.C.
"Dust Palliatives for Roads Surfaced with Gravel or Crushed Rock," by H. F. Laurence, M.E.I.C.
"Maintenance of Gravel Roads," by Lt.-Col. J. MacMillar.

Highway Bridges—Nova Scotia

In introducing this subject Mr. Belliveau stated that the type of structure to be chosen to fulfil the conditions required for any particular situation must necessarily be governed by the class of traffic to be served and, especially in the expenditure of public monies, the authorization available for the project. In general, a permanent bridge means high original cost and low maintenance, and a wooden bridge low original cost and high maintenance, and it is the duty of the engineer to erect a bridge suited to present and anticipated future requirements which, over a period of years will, including original cost, replacements and maintenance, require a minimum annual expenditure. In the province of Nova Scotia, with two thousand large bridges and some twenty-five thousand of smaller type, the engineer must decide whether it is more economical to erect a wooden bridge with a consequent rapid deterioration and comparatively early replacement, or to design a permanent steel structure with permanent foundations and consequent long life and low maintenance cost.

Owing to rapidly increasing traffic on our highways, the cost of replacing a bridge is generally many times its original cost, and the problem of providing adequate accommodation for future requirements must be fully considered by the designing engineer. In general there are four requirements which constantly increase with growing traffic, namely, firmer foundations, longer spans, wider roadway, and greater strength to take care of greater loading.

Formerly the foundations were, like the superstructure, constructed of non-permanent materials and without deep excavation. Now the foundations are built of permanent materials bedded on ledge or on bottoms prepared by deep excavation.

Freshets have greater effect today than in the past owing to the depletion of forest growth, which allows a more rapid discharge of the rainfall into the streams, necessitating a greater opening between bridge abutments with consequent longer bridge spans.

The rapidly growing automobile traffic is mainly responsible for the demand for increased width of roadway, and other conditions which were suitable for horse traffic are entirely inadequate for motor vehicles.

Increasing traffic and modern motor vehicles are, through greater loading, demanding stronger bridge construction. Almost all steel bridges of this province are equipped with wooden stringers and planking capable of carrying a live load of eighty pounds per square foot of floor area, and all steel bridges on important highways are built strong enough to carry a concrete floor, whether the concrete floor is put down at the time of construction or later.

In discussing the maintenance of steel spans, Mr. Belliveau stressed the importance of keeping the steel well protected with paint of approved quality. The experience of the Highways Department of Nova Scotia has been that the best results are attained by the application of a first coat of red lead and a second coat of graphite, of the following analyses:—

First coat—	Red lead,	56 per cent.
	Asbestine,	18 " "
	Boiled linseed oil,	13 " "
	Raw linseed oil,	13 " "
Second coat—	Graphite,	44 per cent.
	Raw linseed oil,	25 " "
	Boiled linseed oil,	25 " "
	Drier,	6 " "

The speaker gave an interesting historical sketch of the bridge development of the highway system of the province, giving detailed accounts of the remarkable life and service of some of the older bridges, tracing the steps in foundation development and describing the various types of trusses in general use.

Construction of Gravel and Crushed Stone Roads

The transition which has taken place since the beginning of the present century, from horse-drawn vehicles to automobiles and auto trucks, has brought with it a corresponding change in highway requirements. The roads, which were suitable for comparatively slow-moving vehicles, are entirely inadequate to stand up under the present-day motor traffic with pneumatic tires and greater speed. It therefore becomes important that the highways engineers of Nova Scotia should not allow themselves to be outdistanced in this race for development. With a total of 15,000 miles of public highways, or about one mile to every thirty-six of our population, the programme must be confined to that class of road which will give reasonably good results for a minimum expenditure of public funds. That class of road is the gravel road, and the most important problem of transportation in this province for many years to come will be the construction and maintenance of gravel roads. Gravel roads are more economical than paved surfaces, when the volume of motor traffic does not exceed 500 to 800 cars per day,—the number depending on local costs and the distribution and wearing qualities of the gravel obtainable.

Mr. Blanchard prefaced his remarks on gravel surfacing with a brief discussion of the preparation of the subgrade. He stated that it has been his experience that, with a 10-ton tractor and suitable grader, a road can be grubbed and graded for about 25 per cent of the cost required to do the same work with the largest horse grader, with the additional advantage of obtaining a more uniform subgrade. It has become the practice in Nova Scotia to build the subgrade flat, or almost flat, between the shoulders of the road, allowing the gravel alone to make the crown of about one-half inch to the foot, rather than, as was formerly the custom, to crown the subgrade to conform to the crown of the finished road. A road with a high peaked crown confines the traffic to two wheel tracks, whereas a flat road invites traffic over all of the gravelled surface.

Referring to gravel surfaces, the speaker said that the erroneous belief prevails among a large percentage of the travelling public that gravel to be suitable for road surfacing must contain sufficient binder to form a smooth, solid cemented mass. Such a surface will very shortly begin to ravel and become full of little pot holes and ripples.

It was formerly the practice in Nova Scotia to put the gravel on in two courses, spread by hand and rolled with a heavy roller. The first course consisted of gravel with a maximum size of four inches and the top course had a maximum size of two inches. The system now in use is to place the gravel in one course of a uniform aggregate with a maximum size of stone of 1½-inch in diameter. The full amount of gravel is all placed in one windrow down the centre of the road, and this gravel is spread with a grader until only about two or three inches is left on the centre of the travelled way, with a windrow on each shoulder of the road. As the centre becomes consolidated with traffic the gravel from the sides is gradually graded into it. The only sort of gravel surface which can be maintained is one where there is enough loose gravel on top to protect the consolidated road underneath with a floating gravel cover of about one inch in depth.

Speaking of the superior surface obtained by spreading gravel with the grader rather than by hand, Mr. Blanchard said: "It is a fact patent to all, that articles manufactured by machinery must of necessity have that mechanical uniformity in their product which the hand-made piece does not display, and here is the special attractiveness of a gravelled road. The great bulk of the work can be machined, and while other surfaces may be more durable, none can compete with its smooth uniformity when properly constructed."

Referring to the deposits of gravel in Nova Scotia available for highway use, the speaker stated that owing to the growing traffic and increased mileage more and more attention will have to be given to the matter of rock crushing as the supply of suitable gravel becomes depleted.

Dust Palliatives

The dust nuisance to the road users, the adjacent residents and to the road builder, has been especially dealt with by the highway engineer in an effort to save his protecting road cushion, his cement and the very road itself, which is literally floating away in clouds of dust. The old time method of water sprinkling is impracticable for country roads, and it has been necessary to apply other means of combating this nuisance.

Heavy oil, light oil, calcium chloride and common salt have been applied with varying results. The Nova Scotia Highways Board has found the use of dust palliatives, such as light oil, or calcium chloride, to be an economical success in the saving of road surfacing. Mr. Laurence explained the system in vogue as follows:—

For trunk roads of twenty to twenty-two feet width between shoulders, the calcium chloride should be spread to a width of about ten feet, which means that when using the motor truck only, a return trip would have to be made to get the desired width. If the supply is kept conveniently at hand, this outfit of motor truck and two men, making the return trip, should be able to cover ten miles of road in a day. The cost per mile of distribution by this method should not exceed $2.50 per mile.

In Nova Scotia two applications will generally be found sufficient for the whole season. The first application should be made in the spring after the road has dried out, and the second application probably about the latter part of August, depending largely upon the amount of rainfall during the summer months.

For the first application, about two pounds per square yard should be applied, and for the second one pound. In other words, the first application requires approximately six tons per mile, and the second application would be three tons per mile. These quantities will, of course, need to be varied to suit the quality of the surfacing material. If there is a percentage of clay present, care must be taken not to give too heavy a coating of the calcium chloride, otherwise the surface may become too wet. These quantities are given for a roadway which has not been treated the previous year. For second year treatment, no doubt one-half of this quantity would be sufficient. Calcium chloride costs approximately $40.00 per ton delivered at any Canadian Government railway station in Nova Scotia, so that the cost of the first application, spread on a newly treated road, would be approximately $242.50 per mile, and for the second application would be $122.50. This makes the total cost for the season $365.00 per mile. For second and subsequent seasons the cost would be about one-half of this.

To maintain a floating surface of about one inch in thickness on a hard gravel or macadam road, under a traffic of from four hundred to five hundred cars per twenty-four hours, approximately two hundred and fifty yards of gravel or crushed rock per mile are required each season. This amount would cost on an average about $750.00. With the use of a light oil or calcium chloride, this amount could be reduced from 25 to 50 per cent, so that where the cost of the gravel or crushed stone is as stated the cost of the treated road would be approximately the same as the untreated. If, therefore, the statements and conclusions given above are to be relied upon at all, it is evident that the Highway Department will be justified in making a far more extensive use of these palliatives than it has done in the past.

Gravel Road Maintenance

Lt.-Col. Miller in discussing the maintenance of Nova Scotia roads stated that, in a maritime district, and one very much cut up with water courses such as Nova Scotia, it is possible to obtain gravel of one sort or another over a very considerable area, and this material, owing to its ease of working and the cheapness of supply, lends itself admirably to road surfacing.

The time has not yet arrived in Nova Scotia for an intensive patrol system on all highways, but experience on main trunk avenues of travel during the past five years has proved that no system can give better results. The patrolman is able to give timely repairs when a small outlay will prevent further ravelling of the surface.

In Nova Scotia frost penetrates to a considerable depth, and when it comes out it leaves a spongy and soft surface which must be worked and consolidated before the traffic cuts it up. Ditches and waterways must be cleared to allow the free flow of moisture from the roadbed and the shedding of rain during the season.

Sufficient gravel in stock piles should be available for the repair of damage and to provide a floating road surface. In gravel it has been found necessary to drag the road surface once for every 600 to 700 cars that pass. It should always be dragged as soon after a rain as possible.

No matter, however, what rules and regulations may be laid down for the maintenance of gravelled roads, the personal factor of the patrolman or the gang foreman must be taken into account. These are the men who do the work ultimately, and the results depend on their judgment. A permanent man must be selected and employed, one of reasonable intelligence, an honest worker, who is not afraid of weather conditions or the ten-hour day. By careful instructions this man's work will soon become a routine, and the maintenance of the roads will be carried on in a creditable manner.

At the conclusion of the papers considerable discussion took place, following which three reels of pictures showing the making of bituminous roads were shown under the direction of H. W. L. Doane, M.E.I.C.

A vote of thanks was moved by A. F. Dyer, A.M.E.I.C., and Mr. F. Thompson for the splendid presentation of the highway problem by the several speakers.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, Jr.E.I.C., Branch News Editor.

A meeting of the Executive Committee of the Hamilton Branch was held on March 16th, 1927, eight members of the executive being present. Several routine matters were discussed, including applications for membership and the report of the nominating committee, which had held a meeting on March 8th. There was a slight amount of discussion regarding the joint meeting with the Toronto section of the A.I.E.E., which is to be held in the Westinghouse Auditorium on April 22nd. Mr. R. C. Bergvall, of the Westinghouse Electric and Manufacturing Company, will deliver an address on "A Mechanical Transmission Model."

A letter from General Secretary R. J. Durley, M.E.I.C., regarding the Papers Committee was read and H. A. Lumsden, M.E.I.C., was nominated as representative of the Hamilton Branch on this committee for the year 1927.

Kingston Branch

G. J. Smith, A.M.E.I.C., Secretary-Treasurer.

The Lighthouse Service of Canada

On the evening of Friday, March 11th, a very successful meeting of the Kingston Branch was held in Ontario hall, Queen's University, to hear an address by J. G. Macphail, M.E.I.C., commissioner of lights in the Department of Marine and Fisheries, Ottawa.

Mr. Macphail took for his subject "The Lighthouse Service of Canada," and dealt with it from both technical and popular viewpoints. A number of very excellent slides and two rolls of motion pictures were shown, Mr. Macphail explaining these as they appeared.

The speaker dwelt on the extent of the lighthouse service, and gave some figures showing that the service is distributed over a coastline of 52,800 miles, which includes both the Atlantic and Pacific coasts, the Great Lakes, and inland lakes and rivers. It is maintained as far north as the Great Slave lake and the Mackenzie river. In addition to the establishments in Canada itself, a number of costly stations are maintained in Newfoundland and Labrador, to serve transatlantic ships destined for the maritime provinces and the St. Lawrence.

Mr. Macphail stated that there are 1,675 lighthouses, 362 fog signals, 556 gas, whistling, and bell buoys, 6 submarine bells, 11 light ships, 8,311 unlighted aids to navigation,—a total of 10,911. The expense of this service is wholly defrayed by the Canadian government. In every other maritime country in the world, except the United States, the whole cost of maintenance of navigation aids is borne by shipping, the cost being collected in the form of "light dues," which are collected before a vessel receives a clearance from customs. A vessel of 10,000 tons, trading between Montreal or Halifax and Liverpool, pays nearly $4,000 a year for light dues in England. She pays nothing in Canada. Consequently, one of the difficulties, the speaker remarked, is that of keeping expenses within bounds. Shipowners in Canada are prone to be extravagant in their demands, but the lighthouse service, while investigating all cases, adopts the attitude of meeting the most vital requirements only; supplying the aids where safety demands them, rather than for spectacular display.

The series of slides and motion pictures illustrated the various types and kinds of lighthouse apparatus, and the methods of operation. Duplicate machines are installed in every case where machinery is necessary, and are used turn and turn about, so that each machine lasts considerably more than twice as long, due to its receiving better attention and care than it would if it were in continuous service. The reels showing the laying and taking up of the buoys between Montreal and Quebec were particularly interesting. The opening and closing of navigation constitutes the most difficult season for the lighthouse service, involving as it does the placing in position of light ships, gas and signal buoys, and a total of 2,818 floating aids to navigation, which must be placed immediately ice conditions will permit in the spring. This work extends from Gaspe to Fort William, and is usually completed within a week. At the close of navigation in the fall, all floating aids to navigation must be removed, but they must be kept in position to the very latest date possible. Long after commercial shipping is safe in winter quarters, the men and steamers of the lighthouse service are still battling with winter conditions in the work of recovering expensive buoys.

In conclusion Mr. Macphail mentioned something of the human side of the service. The men and women of the stations must be within reach of their posts twenty-four hours a day and three hundred and sixty-five days in the year. They cannot fail. Other activities may stop and go. The lighthouse service must be maintained, and in it failure cannot be tolerated. The lights must be kept working, and the other signals constantly efficient. There has never been a failure at any of the principal stations due to inattention to duty. The close contact with nature at the isolated posts develops men and women of a serious, purposeful character, and not a day passes that the marvellous faithfulness of the staff of the lighthouse service is not well shown.

At the close of the address a vote of thanks was moved by Major L. F. Grant, A.M.E.I.C., and received the hearty endorsement of the very large audience present.

Petroleum

A regular meeting of the Kingston Branch was held in Carruthers hall, Queen's University, on Tuesday evening, February 1st. Dr. Bruce Rose, of the Geology Department at Queen's, gave an address on "Petroleum, with Particular Reference to Western Canada."

Dr. Rose has done considerable scientific work in various oil fields, and has spent several seasons investigating the petroleum possibilities of Alberta. His lecture showed a splendid grasp of this very important subject, and proved most interesting to the members present. The lecture was illustrated with a number of maps and geological sketches, showing the nature of the occurrences in Canada and other countries, and numerous statistics were given as to world and different country production.

At the close of the address a hearty vote of thanks was tendered the speaker. An abstract of this paper appears on another page of this Journal.

London Branch

F. C. Ball, A.M.E.I.C., Secretary-Treasurer.

A regular meeting of the London Branch was held in the London Technical and Commercial High School on December 17th, 1926. After a short business session the speaker of the evening, Principal H. B. Beal, was introduced by Chairman W. P. Near, M.E.I.C. Mr. Beal is one of the pioneers of the technical education movement in London and has made an extensive study of the subject which he chose for his address, "Vocational Education for Industrial Purposes."

Vocational Education for Industrial Purposes

It was pointed out that former educational systems led only to the learned professions. In preparing a youth for one of the trades the apprentice system was wasteful of time, about seven years being the usual length of apprenticeship. At the present time the collegiate institutes prepare pupils only for the universities, whereas statistics show that less than five per cent of collegiate students enter a university.

The technical school provides a thorough academic training plus a specialized course. It also helps to meet a great demand for adult education, a demand that is shown by the Carnegie Institute report on correspondence schools.

In regard to the local situation, forty-five per cent of the pupils who go higher than public school choose the technical school. In the first year they spend half their time on general subjects and the other half on more specialized subjects. In the second year, after the pupils have had an opportunity to judge as to the course they wish to follow they are given a specialized course.

The technical school also has a large commercial department, this work having been eliminated from the collegiate institute course. There is a separate secretarial course for those who have had a previous commercial training.

Mr. Beal pointed out that a student may get his matriculation through a technical school without Latin. Boys who contemplate going into engineering would do better to get their matriculation along with drafting, applied science and mathematics in the atmosphere of a technical school.

Mr. Beal mentioned the vocational guidance furnished by the staff and also described the placement department. This department does all in its power to place students, after graduation, in positions in the industrial and commercial world, so that both employer and employee will be satisfied. The products of the school are students. The staff does not claim to turn out skilled mechanics.

Mr. Beal's address was followed by a tour of inspection through the school. Members of the staff very kindly described the work in the departments that were most interesting to engineers.

Annual Dinner Meeting

The annual dinner meeting and election of officers of the London Branch was held in the Blue Dragon tea room on Tuesday evening, January 18th, the speaker of the evening being Brig.-General C. J. Armstrong C.B., C.M.A., M.E.I.C., G.O.C. Military District No. 1.

W. P. Near, M.E.I.C., the retiring chairman, presided until the business of the meeting was concluded. The officers elected for the ensuing year are as follows:—

Chairman	J. R. Rostron, A.M.E.I.C.
Vice-Chairman	J. A. Vance, A.M.E.I.C.
Secretary-Treasurer	Frank C. Ball, A.M.E.I.C.
Executive Committee	H. A. Brazier, M.E.I.C.
	E. V. Buchanan, M.E.I.C.
	Col. I. Leonard, M.E.I.C.
	G. E. Martin, A.M.E.I.C.
	W. M. Veitch, A.M.E.I.C.
Ex-Officio	W. C. Miller, M.E.I.C.
	W. P. Near, M.E.I.C.

Mr. Near in resigning the chair thanked the members for their co-operation during the past year and introduced the chairman-elect and called upon him to address the meeting. Mr. Rostron, after expressing his thanks for the honour accorded him, referred to the very much punctuated attendance at the monthly meetings of some of the members, and pointed out that if any of them stayed away because they considered that the subject listed for discussion was not in their line, they made a great mistake, for, in the first place, a professional engineer was supposed to be fairly well-informed on most subjects, and in the second place, an engineer never knows when he might require knowledge of other branches of work than the one on which he, at the moment, might be engaged. The information thus gained at a meeting, however little, might be of great help to him in the future.

In outlining his programme for the coming year, Mr. Rostron said he hoped to be able to have further visits to engineering works of interest, and speakers on up-to-date engineering subjects, such as arc welding and the use and effects of calcium chloride in concrete, etc. Also the holding of social gatherings now and then to promote comradeship and good feeling amongst the members.

The chairman also stated that he would do his best to uphold the code of ethics of The Institute and also to improve the status of the branch, as he considered that the opinions of a body of professional men such as constitutes the membership of this organization should be given due regard in public matters, particularly those of local import.

Introducing the speaker of the evening, Mr. Rostron called the attention of the members to the fact that the speaker, by reason of his recent location, was now a member of the London Branch, and although this was his first appearance at a meeting, we hoped to see him often in the future at our monthly gatherings.

Work of Canadian Engineers During the Great War

Brig.-General Armstrong, after being acclaimed with musical honours, rose to address the meeting. Reviewing the activities of the Canadian engineers during the war, he outlined the remarkable achievements under the greatest difficulties, and in many cases gunfire, which gave this corps wide reputation. To the Royal Engineers Brig.-Gen. Armstrong paid high tribute, declaring that it was due to their aid and advice that made the work of the corps successful and brilliant. Exigencies of war brought a large number of new branches of engineering service, such as sound-ranging companies which located the exact position of enemy artillery, inland water companies, mechanical companies, forestry corps, mining engineers and railway companies.

Telling of the capture of the Messine Ridge that took place in May of 1917, Gen. Armstrong graphically described the tribulations gone through by the engineers before they were finally able to tunnel under the German lines to a depth of 80 feet and store over a million pounds of high explosives that blew the ridge and its defenders to atoms. The work was accomplished after months of effort, but the million pounds of explosive was not discharged for a year after it was deposited under the Boche entrenchments.

He also described how the engineers cleared the canals along the Scheldt river that had been dammed by the Germans in an endeavour to inundate the countryside that was held by the Allied forces.

Transport of troops, heavy guns and caterpillars across rivers was accomplished by means of pontoons and timber and steel bridges. Many of the bridges were of three spans, necessitating the driving of piles in the river beds with no better equipment than hand pile drivers. The work was often under the enemy's fire, and for that reason it was necessary to construct the bridges in duplicate so that if one was destroyed at a critical moment the other was available. A remarkable feat was the erection of twenty-six bridges, many of them of two- or three-span, in thirteen days. One feature of engineering work in which the Canadians excelled was the making of plank roads over marshy ground.

The chairman in proposing a vote of thanks to the speaker said that he thought "military" engineering might also be called "emergency" engineering, and in that case any engineer in times of peace was liable to be faced with some of the problems of the military engineer, so that any engineer who considered that tonight's subject was not in his line might take note. The vote of thanks was heartily and unanimously accorded.

Mr. Near, city engineer of London, sympathized with the General in the dangerous nature of the military engineer's work under the enemy's fire, but assured him that was nothing to the fire from the public to which a municipal engineer was subjected, for he got it from each side, in front and in the back.

The musical part of the programme was efficiently attended to by Mr. E. G. Wood, who contributed several vocal solos and led the community singing, and by Mr. E. O'Dell, who officiated at the piano, and a hearty vote of thanks was tendered to them.

About twenty-five members and guests were present.

Smoker and Meeting

Looking more to the social side of the branch activities, the London Branch replaced its regular February meeting by a "Smoker and Social," held on February 23rd, 1927. It was thought desirable to foster a spirit of comradeship among the branch members and also to stimulate outside interest in the local activities of The Institute. The branch was pleased to have as its guests a number of men who were interested in construction work and some members from other branches of The Institute. The entertainment was provided by four soloists, who provided a variety of numbers during the evening. Toasts were proposed and responded to at intervals and a spirit of goodwill prevailed throughout.

The attendance at the "Smoker" and at a subsequent regular meeting has demonstrated that the departure from the usual type of meeting was entirely justified.

Recent Progress in Electric Welding

The chairman opened the meeting of March 16th by a short address in which he voiced the importance of the recent advances made in the application of the process of electric welding to structural work, and explained that it was the endeavour of the London Branch to keep its members well informed on up-to-date methods.

He then introduced the speaker of the evening, R. E. Smythies, M.E.I.C., vice-president, Lincoln Electric Company, Toronto, his subject being "Recent Progress in Electric Welding."

Mr. Smythies first described the process and the machinery used, by which it was possible to accomplish two hundred and fifty feet of welding per hour as against a maximum of fifty feet by the acetylene method. He explained that where welding had been employed mostly in the past for mending or patching broken parts it was now, in addition to this, used for structural purposes. Where it was customary to use cast iron for bases and frames of heavy machinery it was now possible to use welded steel frames at a great saving of weight and cost of patterns. He illustrated its application to structural steel work, showing that where tests to destruction had been made the failure occurred in the steel itself, while the welded joints remained intact. The consequent saving in the weight of steel required for construction was obvious, as no allowance had to be made for the loss of metal in the rivet holes. He instanced the saving of cost on the Governor's bridge at Toronto, in which round bars electrically welded were used.

He gave a number of other uses to which the process can be applied with a like advantage, including railway fish plates, concrete reinforcing, boilers and tanks, ships and launches, large pipes, etc. He instanced the construction of a pipe line some three or four feet in diameter and ninety miles long, in California, where all joints are electrically welded. In this work each length of pipe was tested by the application of 250 pounds to the square inch of hydrostatic pressure internally and the seams subjected to a series of blows from nineteen-pound trip hammers applied externally. Another illustration given by the speaker was that of a large gasometer, together with all the steel framing, at Melbourne, Australia, which was erected by the electric welding process without the use of a rivet. The address was well illustrated with lantern slides.

About thirty-four members and others were at the meeting and a thoroughly technical discussion followed, there being representatives present from manufacturing, construction and transportation companies.

The chairman, in calling for a hearty vote of thanks to the speaker, spoke of the value of the process to all structural engineers and predicted increased use for it in the future. The vote was seconded by A. H. Morgan, M.E.I.C., chief engineer of E. Leonard and Sons, and unanimously carried.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

"New Brunswick Night" was celebrated at the regular monthly supper-meeting of the branch, held in the Y.M.C.A. on March 2nd. A. S. Gunn, A.M.E.I.C., chairman of the branch, presided. Excellent vocal and trombone selections were rendered by Mr. Alonzo Johnson. These were greatly enjoyed and heartily encored.

Forest and Ornamental Trees of New Brunswick

Following the supper a paper was read by Prof. H. W. McKiel, M.E.I.C., on the "Forest and Ornamental Trees of New Brunswick." This paper, written by D. R. Munro in 1862, and never published, was obtained through the courtesy of A. G. Tapley, A.M.E.I.C., of Saint John. It depicts in great detail the trees of the province as they existed at that time.

Probably few people are aware that trees once grew in New Brunswick to a height of 150 feet, with a 5-foot diameter base, and yet, sixty-five years ago these giants of the forest were by no means uncommon. Furthermore, species now practically extinct flourished in great abundance. Among the more important commercial woods were tamarack, birch, spruce, fir, maple, oak, pine, elm, walnut, beech, white cedar, ash and hemlock.

During the reading of the paper, illuminated transparencies of the grain and cross-section of the different woods were shown, the slides being kindly loaned by A. C. Selig, M.E.I.C.

Captain J. E. Masters, who was present, spoke briefly, deploring the depletion of our forests. He recalled his first voyage out of Saint John, when the ship on which he sailed carried timber two feet square. Now, he was almost tempted to say, there was not a stick of standing timber suitable for the making of an axe handle.

Mr. Paul Lea, formerly prominent in the lumbering interests in Moncton, said he knew of the forest depletion that was taking place all over the Dominion, and he cited the province of British Columbia, where the ruthless cutting of timber would see that province divested of its timber inside of twenty-five years. Not only were the large timbers falling a prey to the axe of the lumberman, but the fact that in taking out the timber many young trees were destroyed as the larger timbers were dragged over them.

C. S. G. Rogers, A.M.E.I.C., referred to the tragic note sounded in Mr. Munro's paper. Practically every description had ended with the words, "the supply is unlimited." Now, there seems to be nothing worth while so far as large timber is concerned.

Following the discussion on forest preservation, seventy lantern slides showing the resources and tourist attractions of the province of New Brunswick were thrown on the screen. These were obtained from the Natural Resources Intelligence Branch of the Federal Government. The lecture which accompanied the slides was read by Mr. Rogers.

Election of Officers

Immediately following the showing of the slides the meeting was called upon to nominate officers for the season 1927-28. The following officers were elected by acclamation:—

Chairman, G. C. Torrens, A.M.E.I.C.
Vice-Chairman, H. J. Crudge, A.M.E.I.C.
Secretary-Treasurer, V. C. Blackett, A.M.E.I.C.

Professor H. W. McKiel, M.E.I.C., will be an ex-officio member of the executive for the coming year.

More than the required number of candidates were nominated for the offices of committeemen, making an election necessary. This will be held during the coming month and the result announced at the annual meeting of the branch.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

Aerial Surveying

Thursday evening, February 24th, was reserved for the presentation of a paper by a student. The chairman of the evening, H. L. Johnston, S.E.I.C., in opening the meeting remarked that it was the custom to have a paper by a McGill student during the fall session and one by a student from the University of Montreal during the spring session. As no student from the latter university had a paper prepared, Flight Lieutenant Wait, of the Royal Canadian Air Force, a graduate of the Royal Military College, Kingston, and now in the fourth year, civil engineering, at McGill, had kindly consented to read a paper on "Aerial Surveying."

The author mentioned that the making of maps from aerial photographs was first used to any extent on the western front during the Great War, and referred briefly to the subsequent development in aerial surveying.

Mr. Wait described successively the vertical and oblique methods of aerial photographic surveying, by either of which methods the mapping of large tracts of unsurveyed areas is being rapidly and economically carried out by the Topographic Surveys Branch of the federal government in conjunction with the Royal Canadian Air Force, who have done a great deal of pioneer work, particularly in the development of the oblique method of aerial photography. About fifteen photographic crews were employed during last season on this work in different parts of Canada.

In determining the type of survey to be carried out over any particular piece of country the author referred to three points which have to be considered:—(1) geometric accuracy required; (2) economy of time and material; (3) detail.

The first consideration mentioned may react against aerial methods, although the error incurred is comparatively small. The other two considerations will generally be in favour of aerial methods.

The author then described both the vertical and oblique methods of aerial surveying, and the general preparation for the carrying out of the work. The author then gave a brief description of the ground control, by the use of which any error in mapping by oblique photography can be reduced to a minimum.

The paper was illustrated by lantern slides, showing various features in connection with the aerial survey work. Following the paper there was a brief discussion.

The Scientific Method in Industry

That modern industry affords a splendid field for the scientific mind of the engineer was illustrated in the paper presented to the branch on March 3rd by G. Percy Cole, M.E.I.C., technical engineer, Dominion Glass Company.

Already the pulp, paper and varnish industries were entirely under technical control, no major decisions being acted upon without obtaining technical advice.

That any industry might take advantage of scientific methods it was necessary only that someone in the organization possess a scientific attitude of mind with a mania for investigation. To-day countless aids in the way of hand books and scientific instruments of measurement rendered science readily available to even the smallest manufacturer.

However, there existed a more specific and exact application of scientific methods which consisted in, first, reducing the problem to its independent variables, and then ascertaining the laws that influenced each of those variables in turn. Such an application had been demonstrated in the formulation of a law on the cutting of metals, by Frederick W. Taylor.

So, in accordance with these two main principles, the fundamental steps in the investigation of any problem become belief in the necessity for natural law, or the doctrine of "determinism," analysis of the problem with a view to determining the goal, study of the means to be employed toward its attainment, assemblage of the facts bearing on the problem, execution of the projected studies and experiments, and finally, discussion of the results, with utilization of the facts obtained controlled as to accuracy.

"Determinism" is belief in the natural law of cause and effect; it implies disbelief in chance. The active belief in determinism urges us to look for the cause of all anomalies and nearly always enables us to discover the unknown variable. Before a problem may be studied it must be defined, its objective determined and a working hypothesis devised. When once the programme of study has been arranged and the facts assembled, it will then be necessary for the investigator to carry out the experiments with the greatest care, noting all the conditions and confining himself closely to the programme laid down in the beginning. As the purpose of the study has been to discover, a conclusion must be drawn and interpreted, after which recommendations may be offered to correct the conditions for reason of which the investigation was made. Every resource of industrial experience must be brought into play to devise new and improved processes and methods which are at the same time practical; to accomplish this, the investigator must cultivate always a constructive imagination.

In the field of human endeavour, there is no more interesting work than to follow through to a logical conclusion any problem concerning which little is known and where the solution is not evident until all the facts have been determined.

Aside from technical literature there are aids within the reach of every manufacturer which will enable him to scientifically control his product. Foremost among these is the chemical or physical laboratory, where the purity or suitability of any material may be determined. Should it not be economical or advisable to maintain a laboratory of his own, the manufacturer may engage a firm of consultants. This course has the merit of associating with his organization a firm which is in touch with various industries and may thus summon to his aid a wealth of experience which his own organization could hardly be expected to possess, and also of keeping himself in touch with the very latest developments.

One of the greatest aids that is increasing in use implies money invested in indicating and recording instruments. In any event it is well spent, but in relation to the combustion of fuel it is essential.

Another source of help may be had from the standard specification, and such specialized information as is published in the bulletins of the federal and provincial governments and various other organizations.

The scientific method is applicable to the simplification of products, standardization of parts, elimination of waste, determination of costs, distribution and sale of output, survey of markets, location of new industries and to the analysis and investigation of all business and financial ventures.

The author closed his address with the words of Napoleon: "For everything you must have a plan. Whatever is not profoundly considered in its detail produces no good results. Trust nothing to chance."

The meeting was presided over by A. C. Tagge, M.E.I.C., and a vote of thanks to the speaker was moved by F. P. Shearwood, M.E.I.C.

The Purification of Water for Boiler Feed Purposes

A paper on this subject, so vitally important to many enquirers, was delivered on the evening of March 10th by T. R. Duggan, Ph.D., and technical manager of the Permutit Company of Canada Limited.

Dr. Duggan commenced by giving particulars of the impurities in water and how they are absorbed into the water, first in its form as vapour, rain or snow, and later as it flows along in rivers or subterranean streams. In many industrial processes, impurities present in water cause serious damage and loss. In boilers, the impurities in the feed water precipitate as mud, sludge or scale, varying in thickness and hardness. These deposits not only act as insulations, causing loss of boiler efficiency and waste of fuel, but frequently cause local overheating of the tubes, etc., resulting in bulging, tube blowouts, blisters, etc., and the ultimate shutting down of the boilers for cleaning and possible repairs.

These troubles and the expense caused by them resulted in various methods of water purification being devised; those in use at the present day being classified by the author as follows:—removal of suspended matter; settling, coagulation and settling, filtration; removal of dissolved matter. A comprehensive description of the various ways of carrying out these methods of purification was then given.

Dr. Duggan discounted the claims made for the many "compounds" sold for treating boiler feed water and gave his reasons for stating that in most cases they were ineffective in producing the required results.

He referred to the use of precipitation water softeners, the operation of plants for their use and their limitations.

A full description was given of zeolite water softeners and their action in removing impurities. Zeolite plants accomplish the removal of the hardness by percolation of the water through a bed of zeolite material suitably supported and distributed in a container with piping and valves attached to properly distribute and control the flow of water. The hardness is removed by the base exchange principle, the zeolite exchanging its sodium base for the calcium and magnesium bases in the water. A meter is provided to indicate when the softener has passed the quantity of water it was designed to soften. The zeolite bed is then automatically regenerated by passing a solution of salt through the softener. The brine, by a reverse exchange reaction, gives its sodium base to the zeolite, and as it leaves the softener it carries with it in a clear solution the calcium and magnesium extracted from the zeolite. The zeolite is then rinsed free of brine and the softener is again thrown into service by opening the necessary valves.

"Zeolite" was given as originally a mineralogical term derived from two Greek words, meaning "to boil" and "stone," and applied only to a family of well defined hydrous silicates, but now is applied to all base exchange silicates which are used in water softening.

A brief summary was given by the author of the work of chemists on zeolites. Their physical structure is classified into two groups:—(a) porous zeolites, (b) practically non-porous or solid zeolites; a description of each group being given.

The water softening capacity of zeolite is directly proportionate to the active surface of the zeolite in contact with the water. It therefore follows that the porous zeolites have a greater water softening capacity than the solid zeolites.

Particulars were given of the softening capacity of zeolite, rate of softening and rate of regeneration as also of the salt requirements. A description of the operation of zeolite water softening plants followed, and a comparison of the results of zeolite and lime soda,—as also their comparative cost of operation.

The chairman of the meeting was R. E. MacAfee, M.E.I.C. A vote of thanks to Dr. Duggan for his paper was proposed by G. P. Cole, M.E.I.C.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

Electric Arc Welding

R. E. Smythies, M.E.I.C., vice-president of the Lincoln Electric Company of Canada, gave an illustrated lecture on "Recent Progress in Electric Arc Welding" before the branch at St. Catharines on February 28th, 1927. This lecture was given before the Toronto Branch at an earlier date.

The meeting was very well attended, indicative of the interest with which engineers are getting this comparatively modern method of not only repair but construction.

Most of the harder metals used in structural work can be welded; Mr. Smythies particularly mentioned bronze, cast iron, (except the poorer grades), manganese, chromium and other steel alloys.

There are great possibilities in curtailing capital expenditures for plant if, and when, structural steel weldings replace cast iron or cast steel. Instead of the heavy outlay for a large area of land and foundry buildings, together with the necessary furnaces, moulds and patterns, there will be required a comparatively small storage shed containing a limited stock of structural steel shapes and plates. One company mentioned by Mr. Smythies reduced their inventory in this way from some $760,000 to $60,000.

Carl H. Scheman, M.E.I.C., asked the speaker for an opinion as to the relative merits of a.c. and d.c. arc welding. In reply, Mr. Smythies stated that both a.c. and d.c. welding machines were on the market and more or less competitive. His own experience led him to favour the d.c. machines, as, operated at 20 volts against the 100 to 125 volts of the a.c., they seemed to him less dangerous and more easily controlled. Patent rights, he understood, had recently been granted covering a.c. machines, while on the other hand it is unlikely that d.c. machines could be patented.

Mr. Beatie moved a cordial vote of thanks, seconded by S. R. Frost, A.M.E.I.C. Alex. Milne, A.M.E.I.C., was in the chair.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

The Bituminous Sands of Northern Alberta

At an evening meeting of the Ottawa Branch, held in the Chateau Laurier on February 25th, S. C. Ells, M.E.I.C., mineral technologist of the Department of Mines, delivered an address on "The Bituminous Sands of Northern Alberta." Mr. Ells has been engaged since 1913 in the investigation of these sands and believes that they constitute one of the most potentially valuable resources of Canada. The meeting was open to the public, and those who attended gained valuable first-hand information on the extent and value of these deposits, both from Mr. Ells' interesting address and from the slides which showed the deposits in Alberta, the experiments being conducted in Canada and the large commercial developments of similar deposits in the United States and other countries.

Noulan Cauchon, A.M.E.I.C., chairman of the Ottawa Branch, in introducing the speaker, said that he considered it most unfortunate that the deposits of which Mr. Ells would speak were called in Canada, tar or bituminous sands. If only we called them "rock asphalt," people would understand their nature and would realize that rock asphalt is found in many places in the United States and is being largely exploited. It is nothing new, he said, as everybody else is developing it.

Mr. Ells said that if he were an after-dinner speaker he would entitle his address "The Birth of a New Industry." It had been a pioneering job, and he referred to transportation problems and how remote the deposits and their development seemed when he first started to study them. Now, through the modern attainments of the chemical engineer and a study of the problems of transportation and marketing, development of these remarkable deposits seemed to be on the eve of solution.

The bituminous sands of northern Alberta, Mr. Ells told the audience, cover probably from 5,000 to 10,000 square miles. The country had been mapped over an area of 1,250 square miles and a considerable amount of boring had been done, so that now they were in a position to pick out the areas where the overburden was light and the deposits of such high quality as to offer attractive possibilities of development. These bituminous sands, he said, were the largest known deposits of solid hydro-carbons in the world. They would supply paving material for all the roads in Canada and the United States. Just now there appeared to be a market for 150,000 tons per annum and he hoped that shipments would reach to Winnipeg. The development of the deposits was in its entirety an economic proposition, and all that was needed was greater population and reasonable rates of transportation.

Mr. Ells took his audience on a tour to some of the great rock asphalt industries in other countries, illustrating with slides the magnitude of their developments. In Alabama, for instance, a contract had been signed for 1,000,000 tons of rock asphalt at $3.50 per ton. The cost of mining in Alberta would be only about 25 cents per ton as against $1.50 in Kentucky, and yet rock asphalt is being shipped 1,000 miles by rail in the United States. In Sicily a 6 per cent rock is being mined and is shipped to many countries, including India and Brazil. The northern Alberta deposits are very much richer, with a bitumen content of 14 to 18 per cent.

The best surfaces on roads in the United States are of rock asphalt, Mr. Ells said, and pointed out that paving with this material is not a theory but an accomplished fact. In Canada paving experiments dated back to 1915, when a surface was laid in Edmonton on Kinnaird street and it has stood up ever since without cost of maintenance. Mr. Ells strongly commended the work of the Dominion Parks Branch, Department of the Interior, for the work done in experimental paving in Jasper park and of the Mines Department for their enterprise in laying the Edmonton pavement. Next summer the demonstration work with Alberta's rock asphalt will go further, and it is planned to lay this material on clay roads without foundational work. The field of usefulness is constantly widening, the speaker said, and asphalt mastic is coming into use for floors in churches, stations and other buildings. It is very pretty, he said, and provides a good wearing surface. It is also used for lining swimming pools. There is no difficulty, he said, in getting proper paving material in the deposits of northern Alberta and, as for their handling, there is no more trick in laying bituminous pavement than in laying Portland cement.

A lively discussion followed Mr. Ells' address. Replying to a query as to the petroleum content of these deposits, the speaker said he had recently made a very rough calculation which gave the stupendous quantity of 350,000,000,000 barrels of crude petroleum. It constituted the largest potential supply of liquid hydro-carbons in the world. As for asphaltic materials, Mr. Ells said that the Trinidad lake deposit was relatively insignificant when compared with the McMurray, Alberta, deposits.

Operation and Construction of Water Tube Boilers

A highly instructive lecture on the "Operation and Construction of Water Tube Boilers" was delivered at the Victoria Memorial Museum on the evening of March 4th, by J. O. Twinberrow, A.M.E.I.C., under the auspices of the Ottawa Branch. Mr. Twinberrow's address was illustrated with four reels of motion pictures and was enjoyed by a large attendance, including many local boiler engineers and operators.

Introduced by Noulan Cauchon, A.M.E.I.C., chairman of the Ottawa Branch, Mr. Twinberrow, who is engineer-in-charge of boiler, furnace and stoker designs of Babcock-Wilcox and Goldie-McCullough, Limited, briefly reviewed the progress in power plant design, showing how from 1887 to 1925 the coal consumption per kilowatt hour had been reduced from twelve pounds of coal to one pound of coal, and how the boiler pressure had risen from 250 pounds in 1916 to 1,400 pounds in 1926.

These changes have altered completely the methods and ideas of boiler manufacture, Mr. Twinberrow said, and the moving pictures nicely illustrated not only the operation of the modern water tube boiler, but also all the details of its fabrication. The researches between the years 1916 and 1925 necessary to produce the modern high-pressure and high superheat boiler unit were described.

Dealing with some of the details which had to be solved, Mr. Twinberrow pointed out that boiler shells were now made up to five inches in thickness. The tremendous pressure made it necessary to give close attention to the matter of correct fitting of the plates covering the seams. The edges of the shell itself were required to meet within one-sixteenth of an inch. The seam was then covered with a plate machined to exactly fit, and even the rivetting had undergone a great change. The rivets were now machined and ground to give a perfect fit and were rivetted by a special pressure mechanism instead of by hammering.

Speaking of superheaters, Mr. Twinberrow said that because of the belief that previously available steels might lead to difficulty with high temperatures, a new heat resisting chrome-steel alloy had been developed, and with this alloy superheater units may be built capable of withstanding a heat of 900° Fahrenheit.

Many details had been worked out to increase the efficiency of boiler plants, and one which was of especial importance was the heating of the air for draft and combustion.

Joint Luncheon

At a largely attended luncheon in the Chateau Laurier on March 1st, arranged under the joint auspices of the Ottawa Branch of the Engineering Institute and the Ottawa Branch of the Canadian Institute of Mining and Metallurgy, Dr. D. A. Lyon, chief metallurgist of the United States Bureau of Mines, Washington, was the speaker. Noulan Cauchon, A.M.E.I.C., presided.

Dr. Lyon's Address

Dr. Lyon traced the history of the Bureau of Mines of the United States since its inception, stating that at present it consisted of three main branches, technological, economics, and health and safety. The function of the Bureau of Mines, he said, was to provide fundamental data for the information of state governments and mine owners. It could not be accused of acting in a consultative capacity or in any way displacing the consulting geologist or mining engineer, but it did carry on investigations and research which gave the consulting engineer fundamental facts to deal with. As regards the health and safety work, which is an important branch of the Department of Mines' activities, the bureau has not police power, and cannot make regulations, but only recommendations. He spoke of the good results which had come from the investigations of mine operating conditions. The work was largely educational, and to prove to some doubting Thomases the effect of dust explosion they had actually staged an explosion in a mine which the bureau maintained for investigational work.

Dr. Lyon spoke more particularly of his own division of the work, the technological branch. This, he said, is purely a field organization, gathering data to be used by the engineer in his work. One of their greatest problems was the utilization of low grade ores. Just how acute this problem is, Dr. Lyon said, is illustrated by the fact that the use of metals is doubling every ten years. As for the economic results of such investigational work, he said that one-third of the output of copper in the United States is now coming from low-grade porphyry ores which were not considered a feasible source of supply in 1904.

Referring to their co-operative work with the British Government, Dr. Lyon explained that they send one or two of their mining experts to England, and the British Government sends one or two to the United States, and that they exchange information on all subjects of mutual interest.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

With Canadian Engineers in Palestine

At the regular meeting held on the evening of February 24th the members, together with a number of visitors, listened to a very interesting address by Prof. J. Roy Cockburn, M.E.I.C., now associate professor of descriptive geometry, University of Toronto. Prof.

Cockburn's lecture was entitled "With Canadian Engineers Under Allenby in Palestine," and was illustrated with a large number of coloured lantern slides. Some of these photographs had been taken by the official Turkish photographer, who remained behind in Jerusalem when the British arrived. Other photographs were taken by Mr. Cockburn with a pocket kodak. These pictures illustrated very well the varied nature of the country over which these operations were carried out.

Mr. Cockburn was in command of the Seventh Field Survey Company, Royal Engineers, and briefly described first, the military railway from Kantara across the desert to Gaza and Beer-Sheba, and also the water pipe line which ran parallel with the railway. He then passed on to a description of the manner in which the ancient water system of Jerusalem was modernized and put into operating condition by the Royal Engineers.

One interesting point mentioned was the use of wire netting in the making of roads over the desert. These "chicken wire roads" were excellent for infantry and motor traffic. The chief work upon which Major Cockburn was engaged, however, was survey work of various kinds, including location of enemy batteries, photography, map making, etc. The location of batteries was sometimes impossible by visual operation or aerial photography, and it then became necessary for the field survey engineers to use the sound ranging method. This was particularly the case in the Judean hills, where visual operation was practically impossible. The address and slides were very favourably received by those present and a number of questions were asked. A vote of thanks to Mr. Cockburn was proposed by H. O. Fisk, M.E.I.C., and was heartily approved.

Ancient Engineering

Mr. F. H. Dobbin, an old friend of the Peterborough Branch, gave an interesting paper of a rather unusual type at the meeting held on March 10th. His subject was "Ancient Engineering," which he dealt with in a most descriptive and instructive manner.

Pointing out that the science of engineering did not have its origin in any particular stage of history and that no one race or era can lay claim to its inception or birth, every civilization may be said to have contributed its share to the development of this science.

Bridge building may be said to have had its beginning when the first log was thrown across the brook or stream too deep to ford. Hydraulic engineering had its inception when the aboriginal deepened the bed of the rivulet with his naked hand or wooden paddle that he might increase the supply of water for his flocks and herds. The science of steam engineering probably began when Nero or Alexander amused his friends with his revolving steam toy, and electrical engineering when the Chinese coaster steered his junk by a sea shell filled with oil upon which floated a bit of reed with a magnetic needle pointing always to the Southern Cross.

The speaker then described some of the outstanding engineering achievements of ancient times and the manner in which it is believed they were constructed. The pools of Solomon supplying water to the city of Jerusalem consisted of three reservoirs, the smallest one being 400 or 500 feet in length, the waters discharging from one to another in terraced fashion and from the lowest into the city. The principle of aeration for purifying water was, therefore, appreciated even at that time.

The Hanging Gardens of Babylon contained the most interesting hydraulic work of ancient times, providing the means of raising water to the top of the walls, which were said to be 350 feet in height, by means of an endless chain of buckets.

The ability of the Romans to bore tunnels without the aid of explosives was remarkable, there being an instance near Naples, the grotto of Posilippo, length 2,316 feet, width 22 feet, average height 39 feet. There is no record of when or how this piece of tunnelling was done, but it is through carnelian rock, so hard that every inch had to be worked by the chisel.

The Egyptians excelled all other nations in the transportation of heavy masses of stone, and there are examples of columns 47 feet in height, containing 11,500 cubic feet and of about 1,000 tons weight, which were cut from the quarries, transported by land and water, and erected in place. For transportation on the Nile, flat bottomed boats were used, being brought to a basin on the side of the river, heavily ballasted with stone until sunk to the level of the banks, and the monolith of stone then rolled upon the boat and the ballast thrown out.

The architects and engineers of Asia Minor also deserve great credit for the invention of original methods of transportation, for example, the Temple of Diana at Ephesus, (600 B.C.), contained some 127 columns of marble 60 feet in height and about 7 feet in diameter. These were cut and transported from a quarry at a distance of some eight miles, and there still lies in this quarry a partly cut block roughly 70 feet long, 14 feet wide and 11 feet deep.

The use of the inclined plane or ramp was early recognized by the ancients and was undoubtedly used in the building of the Pyramids. Calculations and estimates show this inclined plane was over 3,000 feet in length by 62 or more feet in width and 164 feet above the level of the river Nile. The forging of metals was known without doubt in Egypt and some parts of Asia in the most distant times, a famous example being a forged iron pillar at Kallub, near Delhi, 16 inches in diameter and over 50 feet long.

That there were recognized professional engineers from the earliest times is evidenced from the fact that there existed in Egypt in 3700 B.C. a "superintendent of works" who had charge of the construction and repairs of public edifices and roads, which fact is proved by the discovery of a wooden statue at Sakarah, now in the Bulak museum.

At the conclusion of the paper Mr. Dobbin answered some questions and gave still further examples of primitive engineering work and was tendered a very hearty vote of thanks for his paper.

Quebec Branch

Louis Beaudry, A.M.E.I.C., Secretary-Treasurer.

The Montreal-South Shore Bridge

"The Montreal-South Shore Bridge" formed the subject of a very interesting lecture, illustrated by lantern slides, which was delivered by P. L. Pratley, M.E.I.C., of Monsarrat and Pratley, consulting engineer for the bridge, at an evening meeting held at the Chateau Frontenac on Monday, January 17th.

The speaker, who was introduced to the gathering by A. R. Decary, M.E.I.C., honorary president of the Quebec Branch, gave at first the historic facts concerning the construction of the various bridges between the island of Montreal and the south shore of the St. Lawrence river. He thus showed that the bridge now in course of construction was not a new project by any means, but that it dated back to 1876, when plans were made for the Royal Albert bridge, the purpose at that time being to relieve the railway traffic problem, which has always been a serious one to Montreal, due to its island position. At that early date it was foreseen that ten years later the existing Victoria bridge would be inadequate for the requirements of its owners, the Grand Trunk Railway.

The estimated cost had been five million dollars.

The Lachine bridge was then built by the Canadian Pacific Railway, and the railway traffic congestion was relieved for the time being. In 1897 it was again proposed to erect the Royal Albert bridge, and many engineers from Canada, United States and Europe took part in the competition.

Many of the plans submitted were illustrated with slides and were commented upon by the speaker. Among these plans were those of G. Shaw, which were declared by Mr. Pratley to be a masterpiece in bridge designing, while Henry Szlapka, who designed the plans for the Quebec bridge, was also a contestant. Shaw's plans were approved, but the scheme fell by the wayside through lack of financial backing from the government of that time. The Grand Trunk Railway then rebuilt the Victoria bridge, replacing the tubular structure by the existing bridge and installing double railway tracks. The situation was further relieved in 1909 when the Canadian Pacific Railway double-tracked the Lachine bridge.

From then on the railway traffic situation was improved, but with the advent of the automobile, Montreal's problem became a highway problem insofar as communication with the south shore was concerned. Changes were made on the Victoria bridge in order to improve conditions, but in 1920, following a fire near one end of the bridge, which resulted in the blocking of all traffic on the bridge for four days, a new structure was demanded by the general public.

With this in view the government was approached, but it declined to guarantee the interest on the capital necessary to finance the bridge. Finally, the chairman of the Montreal Harbour Commission persuaded the government to permit the commission to guarantee the cost of building the bridge.

After studying several sites for the approaches and other special features, it was finally decided that the old Delorimier street plan was the most practicable, and work on the structure was commenced.

Several projects presented to the commission in 1924 were shown on the screen. Mr. Pratley then outlined the design of the bridge now under construction, particularly the section over the north branch of the river, which is a cantilever structure with a central span 1,096 feet in length.

The clearance at the centre of the central span is 163 feet at high water, and the greatest height of the main piers, from rock foundation to their top, is 310 feet. The width of the bridge allotted to vehicular traffic is 37 feet, this space being flanked on both sides by street railway tracks enclosed by fences, while footwalks five feet wide will extend from end to end on both sides of the superstructure.

Explaining the scheme adopted for financing the project, the speaker said that the Montreal Harbour Commission was authorized by the federal government to issue bonds covering the cost of the construction, while the provincial and the municipal (Montreal) governments agreed to contribute the deficit on the total amount of the bond issue which is expected to be experienced for the first four or five years.

Mr. Pratley afterwards showed a large number of pictures, illustrating the various operations connected with the building of the bridge and the progress made in this connection. The open and pneumatic caissons were fully described and illustrated.

F. T. Cole, M.E.I.C., thanked the speaker on behalf of the gathering for his address, which proved very interesting.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

Provincial Power

On February 10th the members of the Saint John Branch were addressed by S. R. Weston, M.E.I.C., chief engineer of the New Brunswick Electric Power Commission, on the subject "Provincial Power." A. R. Crookshank, M.E.I.C., branch chairman, presided at the meeting.

In his address Mr. Weston outlined the potential and developed water powers of New Brunswick. The advantages of having all sources of power connected by one transmission system, thus stabilizing demand and load, and the further advantage of having all power markets within the province linked together in one system by transmission lines, was explained in detail. The subject was treated in a broad technical manner without any attempt of indicating policy or method of development. The subject is of general interest at the present time on account of the works under construction and contemplated for the near future.

A vote of thanks to the speaker was tendered by the chairman on motion of Geoffrey Stead, M.E.I.C., and J. N. Flood, A.M.E.I.C.

Joint Meeting at Fredericton

On Friday, March 4th, a party of fourteen members of the Saint John Branch left by an afternoon train for Fredericton for the purpose of holding a joint meeting with the Engineering Society of the University of New Brunswick. On arrival at Fredericton the members went directly to the university and were the guests of the students at supper, following which a tour was made of the college buildings.

The meeting was opened by C. M. Steeves, S.E.I.C., president of the Engineering Society, who welcomed the members of the Saint John Branch to the meeting and then called on A. R. Crookshank, M.E.I.C., to take charge. The programme had been prepared to embrace several phases of engineering, and the Papers Committee was fortunate in their choice of subjects and in their arrangement of a diversified programme.

Railway Location

The first paper was read by A. S. Gunn, A.M.E.I.C., of the Canadian National Railways, Moncton, on the subject of "Railway Location." This paper related the experiences anyone might expect to encounter who, as the speaker expressed it, "by ill-fortune or ill-advice found himself a member of a railway survey party." It related personal experiences and made the older men reminiscent of similar experiences in their own early survey days. The various features of reconnaisance, preliminary and location surveys were dealt with in turn. What otherwise would have been a dry subject was treated in a humorous manner and yet brought home necessary truths which every student and novice must observe on railway and general survey work.

Operation of Electric Systems

The second paper was delivered by G. A. Vandervort, A.M.E.I.C., of the New Brunswick Electric Power Commission, on "Operation of Electric Systems." The matter was treated as dealing with operating practice in general and was not a description of any particular system. It again related incidents as gained from personal experience and gave the students in particular a practical idea of what might be expected when employed in the electrical business. The speaker described the organization required and the methods used in the operation of a combined generating, transmitting and distributing system. A noteworthy feature of this address was the well-deserved tribute paid to the high type of men attracted to this branch of work and their devotion to duty in all kinds of weather and other inconveniences.

Features of Saint John River Power Company's Development at Grand Falls

The third address on the programme was given by A. C. D. Blanchard, M.E.I.C., speaking on "Some Features of the Saint John River Power Company's Development at Grand Falls, N.B." The speaker described the early history relative to the power at Grand falls on the Saint John river, and of the various groups to whom was intrusted its development during the past quarter century. Finally, Grand falls is now being developed by the Saint John River Power Company, a subsidiary of the International Paper Company. The various engineering investigations preliminary to construction were briefly traced by the speaker, who stressed the necessity for storage on this river with a discharge ranging from 1,000 to 130,000 cubic feet per second. The natural head at Grand falls is between 112 and 118 feet, depending on the stage of the river, and this is being increased by about 14 feet by a dam now being built. A feature of the development is the construction of a tunnel with 24½ feet finished diameter under the town of Grand falls. The development provides for three units of 20,000 h.p., with present construction to be completed by July, 1928.

A number of slides of Grand falls construction scenes were shown, and a discussion followed the reading of the papers.

A resolution of regret at the death of A. R. Wetmore, M.E.I.C., whose funeral was held at Fredericton that afternoon, was moved by Geoffrey Stead, M.E.I.C., and seconded by G. G. Murdoch, M.E.I.C. Mr. Wetmore, as provincial bridge engineer, was held in high esteem throughout the province.

A vote of thanks to the chancellor and faculty of the University of New Brunswick for the invitation to hold the meeting at the college buildings, and to the several speakers for preparing and delivering addresses was passed on motion of Alex. Gray, M.E.I.C., and E. A. Thomas, A.M.E.I.C.

At this stage of the meeting the branch chairman retired from the chair and the Engineering Society again took charge. Dr. C. C. Jones, chancellor of the university, thanked the members of the Saint John Branch for coming to Fredericton for the meeting and generously extended an invitation for similar meetings in the future.

A number of citizens of Fredericton, including some members of The Institute resident there, were present at the meeting.

The members of the Saint John party returned to Saint John by various trains the following day. All voted having had a most enjoyable trip, as all similar preceding trips have also been. The Saint John Branch attempts to hold one joint meeting in Fredericton each year as a means of showing its interest in the university within its branch territory. This is in line with the policy of The Institute of co-operating with all colleges giving courses in engineering.

St. Maurice Valley Branch

R. Morrissette, A.M.E.I.C., Secretary-Treasurer.

The monthly meeting of the St. Maurice Valley Branch of the Engineering Institute of Canada took place on Saturday, March 19th, at 4 o'clock p.m. in the rooms of the Chamber of Commerce, Three Rivers. There were present Ellwood Wilson, M.E.I.C., C. L. Arcand, A.M.E.I.C., J. A. Bernier, A.M.E.I.C., H. Dessaulles, A.M.E.I.C., B. Grand Mont, A.M.E.I.C., C. H. Jette, A.M.E.I.C., L. E. McCoy, A.M.E.I.C., R. Morrissette, A.M.E.I.C., H. J. Ward, A.M.E.I.C., A. A. Wickenden, A.M.E.I.C.

Bruno Grand Mont, A.M.E.I.C., was nominated as councillor of the St. Maurice Valley Branch, and S. W. Slater, A.M.E.I.C., was nominated as representative of the branch on the Papers Committee. A motion was passed congratulating President A. R. Decary, M.E.I.C., on the great honour accorded him by the University of Montreal in conferring on him the degree of D.A.Sc.

Aerial Surveying

Ellwood Wilson, M.E.I.C., chairman of the branch, delivered an address on aerial surveying, which was illustrated with slides. He pointed out that aerial surveying readily furnishes details which ordinary surveying methods have not been able to give, and these are obtained at a very moderate expense. A survey ordinarily costing from $700 to $800 per square mile can be made by aerial methods for from $40 to $100 per square mile.

Aerial methods have the further advantage that if an error or omission is made in the notes of an ordinary survey it is difficult, if not impossible, to correct it, whereas the photographic methods do not overlook anything.

A survey which would last for months if ordinary methods were used, can be made by aerial methods in a few days. In the case of the plan of a city, many details are shown which it is impossible to show on a map plotted from an ordinary survey. The principal aerial surveys made to date are those of the cities of Ottawa, Quebec and New York. In the case of a transmission line, it is possible to take a series of pictures from the air and use these in purchasing land for right-of-way. This has been done by the Hydro-Electric Power Commission of Ontario, the Shawinigan Water and Power Company and the Belgo-Canadian Company. Large purchases of timber limits have been made on the results of aerial surveys; for example, the limits of the Laurentide Company and those on the Gatineau, which have been bought by the Canadian International Paper Company.

Aerial surveys have also been found of great value in the preparation of plans for taxation in cities and rural districts, and also plans for insurance companies, giving all the details of the relations of a property with the neighbouring properties, thus assisting greatly in judging of the nature of the risk.

Mr. Wilson explained the opertation of the camera in the aeroplane, and stated that an apparatus is now available which takes nineteen square miles in one operation. He thought that in the district of Three Rivers a very suitable landing place can be found at Cap de la Madeleine, and expressed the hope that an aerial service between Montreal and Quebec will be operation this summer.

On motion of Mr. Dessaulles a cordial vote of thanks was passed to Mr. Wilson, which concluded a very successful meeting.

Saskatchewan Branch

R. W. E. Loucks, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held in the Kitchener hotel, Regina, on February 18th, preceded by a banquet. Vice-Chairman M. B. Weekes, M.E.I.C., presided at the meeting, which was attended by thirty members and guests.

At noon, prior to the meeting, some fifty members of the branch made an inspection tour of the C.P.R. hotel at Regina, now in course of construction. The details of construction were explained by H. S. Bare, A.M.E.I.C., resident engineer for the company. Mr. D. Smith, of Smith Bros. and Wilson, general contractors for the building, accompanied the party.

Construction of C.P.R. Hotel at Regina

At the evening meeting Mr. Bare gave an address on the construction of the hotel. Excavation was commenced in June, 1926, and it is expected that the building will be ready for occupancy by June first next. There has been no cessation of work on account of the winter season. The building is a steel-framed structure of modern type, having span-drill beams at every floor to carry exterior walls independent of the wall below. Concrete and brick work were carried on in November and December with temperatures ranging from zero to 20 degrees below. Gravel concrete was used throughout, having an aggregate of about 1-3-5 for walls and 1-2-4 for structural slabs. Steam coils were used to heat the gravel and the mixing water for concrete, and as an additional aid to rapid setting one hundred pounds of calcium chloride were added to each twenty-five gallons of mixing water. One-half gallon of the solution was used per sack of cement, less water being used in the mix due to the presence of the calcium chloride.

The foundation was excavated with a one-yard drag line gasoline operated shovel, and the banks of the excavation stood with a fairly steep slope without the use of sheet piling. As only the rear portion was carried down to the 24-foot level a heavy retaining wall had to be built the full length of the basement foundations. This wall had buttresses at about 10-foot centres and to prevent any settlement at their base ordinary wood piling was used.

After the excavation was complete four to six inches of concrete was poured over the whole area, and this slab was given three coats of pitch and three-ply felt protection against damp before the mat foundation proper was put in place. The latter is of the ordinary inverted reinforced T-beam construction, the inverted slabs being generally about 2 feet thick, and the webbs of the T-beam 34 inches deep, including slab thickness, by 36 inches wide, the span generally being about 12 feet 6 inches. Both the slab and the T-beam webbs are heavily reinforced to prevent settlement, and in some cases steel girders over 40 feet in length were imbedded in the webbs for this purpose.

The mat was carried out about nine feet in front of exterior walls to increase bearing area and as the sub-basement is below the level of the city sewers a sump and ejector pumps have been provided to take care of the lower drainage system.

The walls are all thirteen inches thick, while the partitions are mostly four inches thick and are built of either clay tile or gypsum blocks.

The floor slabs are mostly two inches thick. They are composed of gravel concrete and are supported by joists spaced at about two foot centres except under partitions, where they are doubled up. The joists are from eight to ten inches deep and generally have a span of about twelve feet six inches. They are supported directly on steel I-beams, to which they are wedged, and the concrete was poured directly on to a very light low rib mesh, the latter being carried by and wired to the joists. No wooden forms were used, and while there is a certain leakage of concrete through the mesh this was easily scraped up on the floor below and put back into place.

There are numerous kinds of floorings used in the public space, principally red quarry tile in the service portion and Terrazzo with brass strips in the principal rooms. The ball room floor will be of hard wood. The bedroom floors and corridors are all concrete; the former being ¾ of an inch thick and the latter 1½ inches. This finish consists of a mortar composed of three parts sand and two parts Portland cement. As a dust preventative the concrete finish will be treated with a solution of sodium silicate.

There are three 200 h.p. boilers of the water-tube type to take care of heating and power requirements. Exhaust steam is utilized for heating purposes. All returns are carried back to a feed water heater from which they are pumped into the boilers by feed pumps. Mechanical stokers are installed, also blower equipment for induced draft.

A complete water softening plant is provided, having a capacity of eighty-two hundred imperial gallons per hour and a total capacity of not less than thirty-two thousand gallons per regeneration. The plant is designed to treat Regina water to zero hardness, based on the water having not less than forty-four grains of hardness per imperial gallon, and all the water used in the building, including pump make up, is treated before it enters a suction tank in the sub-basement, from which it is pumped to storage tanks on the roof.

Mr. T. E. Chester, manager of the C.P.R. hotel, gave an address on the management of a modern hotel. He described the duties of his staff, which he is now selecting, which will number two hundred and thirty, about sixty of whom will be imported. The public spaces include a ball room, main dining room and grill room, with accommodation for four hundred and fifty, three hundred and twenty-five and one hundred and twenty-five guests respectively. Each of the two hundred and eighty bed rooms is supplied with a bath. A unique feature is being introduced in that all female help will live outside the hotel. A modern garage and filling station will be operated at the rear of the hotel for the benefit of the guests. The name of the hotel has not yet been announced by the company.

Annual Meeting

The tenth annual meeting of the branch was celebrated by a banquet at the Kitchener hotel, Regina, on the evening of March 8th, 1927. W. H. Greene, M.E.I.C., of Moose Jaw, presided over the gathering of forty-one members and guests. Following the dinner each member and guest was introduced by the party sitting on his left. The guests were then welcomed by the chairman.

The toast list was commenced by drinking to "The King." After the toast the minutes of last regular meeting were read and adopted. The business part of the programme consisted of reports of executive and standing committees.

Mr. W. G. Laird delighted the audience with a solo, after which the retiring chairman, W. H. Greene, M.E.I.C., thanked the officers and members of the branch for the support they had given him during his term as chairman.

Prof. A. R. Greig, M.E.I.C., of the University of Saskatchewan, extended greetings from the Saskatoon members. He stated that the staff and students of the university appreciate the scholarship which is given annually by the branch. He next described his recent extended tour of Europe, referring briefly to many of the outstanding engineering achievements in power production and research in England, France, Italy, Switzerland, etc.

Miss "Slippod," the crystal gazer, entertained the audience by some clever delineations of the past and the future of a number of the members present. The pronouncements caused some surprises and much amusement.

R. N. Blackburn, M.E.I.C., on behalf of the branch, presented Prof. Greig with an Institute badge in recognition of his services as past chairman of the branch. Prof. Greig joined The Institute in 1895 and has always been an active member.

Mr. E. T. Fitzsimmons, who was a guest at the meeting, told of his activities in gold mining at Cedar creek, in the Cariboo district of British Columbia. He sounded an optimistic note as to the mineral potentialities of northern Saskatchewan.

The toast to "The Province" was proposed by M. L. Moyer, BRANCH AFFILIATE, who prophesied great development in the near future in clays, coal, water powers, etc. He believed that within a few years many of our highways would be paved, and Regina and

Moose Jaw would be drawing their water supplies from the South Saskatchewan river. The response was made by D. A. McNiven, M.L.A., for Regina city. Mr. McNiven, in a rousing address, complimented the branch and engineers in general on their achievements. He referred to the boundless assets of the province in our coal and clay fields, sodium sulphate deposits, minerals, water powers, etc. He complimented the branch on the inclusion of three of its members on the Power Commission recently appointed by the provincial government. In Australia a similar power commission had been a success in aiding commercial development from the lignite coal fields. He referred to the Power Commission as the "White Hope of Saskatchewan." "The greatest asset of our province is our people," declared Mr. McNiven. "Composed of many races, our citizens were virile, energetic and leaders, as evidenced by the many world's championships won in grains, stock, etc."

The toast to "The Institute" was proposed by T. M. Molloy, BRANCH AFFILIATE, commissioner of the Bureau of Labour and Industries for the province. Mr. Molloy stated that all we require is people with vision and capital to put all our engineers and many more to work. The Institute means a great deal to the engineer; it is an incentive to study and maintains the ethics of the profession. The response was given by Lt.-Col. A. C. Garner, M.E.I.C., who briefly traced the history and traditions of The Institute from its beginning as the Canadian Society of Civil Engineers. The speaker congratulated Dean C. J. Mackenzie, M.E.I.C., of the University of Saskatchewan, a past chairman of the branch, on his winning the Plummer medal, awarded at the recent annual meeting of The Institute at Quebec. In Saskatchewan the opportunities in engineering have been limited, but with the appointment of a power commission the entry of our members into public life, he predicted great possibilities for the future. Col. Garner ended with the admonition, "who dreams shall live."

Election of Officers

The scrutineers presented their report as showing the election of officers to be as follows:—

Chairman, M. B. Weekes, M.E.I.C. .... Regina
Vice-Chairman, A. M. Macgillivray, A.M.E.I.C. .... Saskatoon
Secretary-Treasurer, R. W. E. Loucks, A.M.E.I.C. .... Regina
Executive Committee (elected for two years):
- D. A. R. McCannel, A.M.E.I.C. .... Regina
- W. R. Warren, A.M.E.I.C. .... Regina
- W. G. Worcester, M.E.I.C. .... Saskatoon

Nominating Committee:
- R. N. Blackburn, M.E.I.C. .... Regina
- H. S. Carpenter, M.E.I.C. .... Regina
- A. R. Greig, M.E.I.C. .... Saskatoon
- C. J. Mackenzie, M.E.I.C. .... Saskatoon
- J. R. C. Macredie, M.E.I.C. .... Moose Jaw, (convenor)

D. H. Lunan, BRANCH AFFILIATE, and G. G. Fitzgerald, A.M.E.I.C., were elected auditors by acclamation.

M. B. Weekes, M.E.I.C., the newly-elected chairman, took the chair and thanked the members for the honour they had conferred upon him.

A vote of thanks was tendered the retiring executive and committees, and to those who had taken part in the annual meeting.

Report of Executive Committee

Your Executive Committee respectfully submits the following report covering the conditions of the branch and its operation during the past year.

The membership is 107, as compared with 112 reported this time last year, and is made up as follows:—

Honorary Members	1
Members	16
Associate Members	70
Juniors	6
Students	6
Affiliates	2
Branch Affiliates	6
Total	107

The executive held seven meetings for the transaction of branch affairs. There were six regular meetings of the branch, one social evening and one special summer meeting. The summer meeting was held in camp in River Park at Estevan, Sask., on July 8th, 9th and 10th, and was attended by our general secretary, R. J. Durley, M.E.I.C., and by other notable guests. It was a joint meeting in conjunction with the Saskatchewan section of the American Institute of Electrical Engineers and the Southern Saskatchewan section of the Canadian Institute of Mining and Metallurgy.

Special matters referred to the executive by the general secretary pertaining to Students' prizes, recruiting of new members, cooperation with Boards of Trade, etc., were considered and suitable action taken thereon.

Attached hereto is the financial statement for the year, showing revenue and expenditure, also assets and liabilities. This statement has been examined by your auditors. Although no branch assessment has been levied since 1925, the assets show a surplus over liabilities of $418.79 as against a corresponding surplus last year of $317.61, or an increase of $101.18. Accounts payable this year are $48.75, as against $156.47 last year. Branch news produced a revenue of $34.64, and with the exception of the summer meeting at Estevan, towards which a special donation of $50.00 was received, the meetings have been practically self sustaining.

During the past year we have received rebates of 30 per cent from the dues paid to headquarters, owing to our corporate membership being less than one hundred.

On behalf of the Executive,

R. W. E. Loucks, A.M.E.I.C., *Secretary-Treasurer.*

Financial Statement—1926-27

Revenue		
On hand from 1926	$113.38	
Meetings	185.25	
Headquarters rebates	221.40	
Branch dues	55.00	
Donation towards Estevan meeting	50.00	
Branch News	34.64	
		$659.67
Expenditure		
Office expenses	$ 67.47	
Meeting expenses	250.16	
Honorariums	150.00	
Scholarship	50.00	
Sundries	26.50	
Bank balance	115.54	
		$659.67
Assets		
Bank balance	$115.54	
Estimated headquarters rebates, 1927	220.80	
" " arrears, 1924-25-26	92.70	
" branch dues, 1927	25.00	
" " assessments, arrears 1923 and '25.	36.50	
Furniture and library	50.00	
		$540.54
Liabilities		
Branch dues paid in advance	$ 23.00	
Scholarship for 1927	50.00	
Accounts payable	48.75	
Surplus	418.79	
		$540.54

This is to certify that we, your auditors, have examined the books and vouchers of the Saskatchewan Branch of the Engineering Institute of Canada and believe the above statement represents the correct financial position of the branch.

J. McD. Patton, A.M.E.I.C.,
Stewart Young, A.M.E.I.C.,
Auditors.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

The regular meeting was held in the Y.W.C.A. rooms on February 25th, 1927, with G. H. Kohl, A.M.E.I.C., chairman, presiding.

The guests at the dinner were Messrs. E. V. Ahara, A. H. Clarke and H. Schofield, of the Combustion Engineering Equipment of Montreal and Toronto, and also Mr. Charlton, of the Reynolds Company, of England.

Mr. Ahara gave a splendid paper on "Economy in Steam Generation," which was well explained by the use of a splendid series of slides prepared by the speaker.

Mr. Charlton gave a short talk on "The Comparison of Fuels Used in Great Britain and Canada."

Following Mr. Ahara's address, a lengthy discussion was carried on. The principals who took part were Messrs. R. Gascoigne, chief steam engineer of the Lake Superior Paper Company; John Shields, chief steam engineer of the Algoma Steel Corporation, and Carl Stenbol, M.E.I.C., mechanical superintendent of the Algoma Steel Corporation.

C. H. E. Rounthwaite, A.M.E.I.C., moved a hearty vote of thanks to the speakers and those taking part in the discussion. His expression of appreciation was seconded by all present.

Vancouver Branch

F. P. V. Cowley, A.M.E.I.C., Secretary-Treasurer.

Recent Developments in Oil Engines

At the regular meeting of the branch on February 16th, a paper was presented by Dr. H. F. C. Letson, M.C., Ph.D., on "Recent Developments in Oil Engines." There was a record attendance of members to hear this very interesting paper.

Recent Advances in Metallurgy

On March 9th Prof. H. N. Thomson delivered an address on "Recent Advances in Metallurgy."

Speaking at first in humorous vein on the subject of "lost arts," Prof. Thomson brought home to his hearers the fact that at least in the "art" of smelting most substantial advances had been made in modern times, and especially in very recent years, over any methods used or results obtained by the ancients.

He referred in the copper industry to flotation and differential flotation, showing how now from 76 to 95 per cent of the copper is saved by modern methods, and that whereas in 1884 the output per furnace per day was about twenty tons of copper, it is now six hundred.

In referring to the iron and steel industry, Prof. Thomson exemplified the advances made by showing that in India, by ancient methods four people in ten hours produce fifty pounds of iron. Using the same methods it would require 100,000 people to produce as much iron as one modern blast furnace. Tremendous advances had been made in furnace methods. Early furnaces had required five tons of charcoal to make one ton of iron, whereas now only one ton of coke was required to make one ton of iron.

The advances in the use of chromium steel were also briefly touched upon; and in the very instructive discussion following the paper reference was made to monel metal, stainless steel, corrosion of ships' hulls, and other subjects, illustrating the interest taken generally in metallurgy.

At the conclusion of the discussion a hearty vote of thanks was tendered the speaker on the motion of W. H. Powell, M.E.I.C.

Victoria Branch

K. M. Chadwick, M.E.I.C., Secretary-Treasurer.

At a well attended meeting of the branch on January 26th, F. G. Aldous, A.M.E.I.C., lieutenant of the Royal Engineers, gave an illustrated lecture on his "Experiences of an Exploratory Mapping Expedition in Syria."

Mr. Aldous described the work of a survey carried out between Damascus in the south and Aleppo in the north, which was undertaken at the instance of the War Office by the Seventh Field Survey Company, Royal Engineers, under the technical control of the Survey of Egypt. He explained that the survey of Egypt extended as far as the Suez canal, but that during the early part of the Great War the work was extended ten miles eastwards of the canal. In this work the usual plane table methods based on triangulation were used. The survey covered an area five to fifteen miles wide along the coast north of Sinai and in Palestine it covered the whole of the theatre of operations past Gaza, where the Turks were defeated, and through to Damascus. The instructions were to carry on this work through to Aleppo.

In the course of his address Mr. Aldous referred to a large map and explained how the deep gorge of the Abana river became narrow just north of Damascus, causing considerable difficulty in the triangulation work at this point.

Mr. Aldous described the various towns through which the survey passed and showed a number of interesting slides of local conditions. At the close of the address a hearty vote of thanks was tendered to Mr. Aldous.

Town Planning

On February 25th an interesting and instructive address was delivered before the branch on the subject of "Town Planning" by W. Brand Young, A.M.E.I.C., of Vancouver.

Mr. Young emphasized the importance of this work, which he defined as "laying out the skeleton of a city in order that its control and growth may follow along logical lines." He gave a detailed description of the garden city established at Letchworth, Herts, England, in 1903, the plans of which were inspired by Sir E. Howard's book, "Garden Cities of Tomorrow," published in London in 1898. He then described at some length the principles of the zoning system and concluded by emphasizing the importance of careful planning of the street system in connection with any proposed city planned.

Preliminary Notice

of Applications for Admission and for Transfer

March 16th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in April, 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ALDEN—LANGFORD TAYLOR, of Vancouver, B.C., Born at Troy, N.Y., Jan. 7th, 1887; Educ., C.E., Rensselaer Poly. Institute, 1909; 1909, 6 mos. Nat. Bridge Works, N.Y.C., dftsman; 1910, 4 mos. N.Y., New Haven & Hartford Ry., mtce. of way; 1910-11, Mexico N.W. Ry., dftsman, designer and i/c erection of bridge abutments; 4 mos. Standard Oil Co. designer and 8 mos. as head dftsman; 1912-15, designer (3 mos.) and designing engr., Board of State Hbr. Comm'nrs of San Francisco; 1914-15, design of piers, apt. houses, theatre, bridges, in partnership with Alden & Pyle; 1916-19, in French Army, demob. as lieut.; 1919, report on economics and design of wireless towers with J. G. White Engrg. Corp., N.Y.C.; 1920-21, with Fowler, Boyd, Leighton & Dubois, Inc., as engr. for the Orient, headquarters in Kobe, Japan, on importation of engrg. material and machinery with preliminary estimates and layouts for industrial plants, last 8 mos. as mgr. for Japan; 1922, with Bureau of Highways of State of Idaho i/c design of 80 bridges; 1923-24, with J. G. White Engrg. Corp., N.Y.C., as asst. engr. i/c design 2 refineries and some power plants; 1924-26, with Sydney E. Junkins Co. Ltd. as asst. engr. on Pier B.C. at Vancouver; 1926, preparation of preliminary plans and approx. costs for new pier development in Vancouver Harbour; at present, in private practice as consulting engr. in Vancouver.

References: E. A. Wheatley, S. E. Junkins, W. G. Swan, H. W. Frith, J. R. Grant.

BOIVERT—CHARLES HENRI, of Quebec, Que., Born at Montreal, Feb. 2nd, 1904; Educ., C.E., Univ. of Montreal, 1925; 1925-26, student's training with Shawinigan Water & Power Co.; 1926 to date, asst. to the ch. engr., Quebec Public Service Comm'n.

References: A. Lariviere, A. Frigon, H. Cimon, F. C. Laberge.

CARRUTHERS—JAMES ALEXANDER, of Lethbridge Alta., Born at Chesley, Ont., Aug. 4th, 1879; Educ., high school, I.C.S. course steam elect. 3 yrs., private tuition dfting and thermodynamics, first-class engrs. tests in Alta. and B.C., 1910-11; 1898, engrs. apptce., Barckman-Kerr Milling Co., Wetaskiwin, Alta.; 1899-1902, engrs. and machinist apptce., Calgary Water Power & Light Co.; 1902-04, power house shift engr. steam and hydro-elect. plants, same Co.; 1905-07, power house engr. i/c shift in steam-elect. plant C.P.R. mines, Bankhead, Alta.; 1907-10, machinist, same Co. and place; 1910-14, master mech. and ch. engr. C.P.R. mines, Hosmer, B.C.; 1914-18, master mech. and ch. engr at Michel, B.C., for Crow's Nest Pass Coal Co.; 1918 to date, master mech. and ch. engr. C.P.R. mines, Lethbridge, Alta.

References: L. Stockett, B. L. Thorne, C. C. Richards, P. A. Fetterly, J. T. Watson, R. Livingstone, J. B. deHart.

HANNAN—RALPH D., of Montreal, Que., Born at New Haven, Conn., Jan. 29th, 1900; Educ., Ph.B. course in C.E., Yale Univ., 1921; 1922-23, structural detailing, Hay Foundry & Iron Works, Newark, N.J.; 1923-24, structural detailing, Can. Vickers Ltd.; Feb. 1924 to date, structural designer with, Feb. to Nov. 1924, Can Vickers Ltd.; Dec. 1924 to July 1925, John S. Metcalf Co., July 1925 to present, Dom. Bridge Co. Ltd.

References: D. C. Tennant, F. P. Shearwood, A. Peden, L. C. Hill, G. H. Duggan.

MANOCK—WILBUR R., of Bridgeburg, Ont., Born at Farmer City, Ill., Aug. 25th, 1886; Educ., B.S. in C.E., Univ. of Ill., 1910; 1910-11, asst. to county engr., Erie Co., Ohio; 1912-16, dftsman, Chicago Bridge & Iron Works; 1917-22, ch. dftsman, same Co.; 1923-24, asst. mgr. operations, Horton Steel Works Ltd.; 1924 to date, mgr. of operations, Horton Steel Works Ltd.

References: C. H. Scheman, E. M. Proctor, W. B. Redfern, R. W. Downie, R. L. Hearn, C. S. Boyd.

McDUNNOUGH—RALPH BAYLIS, of Quebec, Que., Born at Montreal, Feb. 24th, 1876; Educ., B.A.Sc., McGill Univ., 1895; 1904-07, supt., Sorel Electric Co.; 1907-13, mgr., North Shore Power Co.; 1914-24, gen supt., Public Service Corp. of Quebec; 1924 to date, ch. engr., Quebec Power Company.

References: J. C. Smith, F. B. Brown, C. V. Christie, A. B. Normandin, J. Morse, P. S. Gregory, A. R. Decary.

McMURTRY—LAWRENCE CARLETON, of Bridgeburg, Ont., Born at Galt, Ont., Aug. 12th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1922; 1921, dftsman, Sarnia Bridge Co., asst. to ch. of party, Geodetic Survey of Can., N.S.; 1922, observer, Geodetic Survey of Can.; 1922-23, dftsman, Horton Steel Works; 1923 to date, supt. of erection, Horton Steel Works Ltd. 1915-19, served with Allied armies, to 1917, gunner, artillery, France, 1917-19, lieut., artillery, Mesopotamia.

References: C. H. Scheman, R. W. Downie, C. S. Boyd, C. R. Young, E. M. Proctor.

MOLKE—ERIC CHARLES, of Toronto, Ont., Born at Joachimsdorf, Austria, Aug. 16th, 1900; Educ., graduated from Technische Hochskule, Vienna, Dec. 15th, 1923; 1921 (summer), Redlich & Berger, engrs. and contractors, water power station; 1922 (summer), Wasserkraftaktiengesellsch W.A.G. community of the city of Vienna, water power station; 1924-25, J. Pfletschinger & Co., surveying for water power stations; iron works, Johann Perizz; Nensiedler Pulp & Paper Co. for water supply system of town of St. Wolfgang, designing, estimating quantities for the above-mentioned plants, also for Alpine Montan A.G. Heyrische, woodworking industry Kohleben, A.G. for towns of Mariazell and Gusswerk, power plant Sussenberg, reconstrn. of a dam near Amstetter, Austria, project of a dam near Tangerang, Java, supt. for equipment of a testing laboratory, Pfletschinger & Co.; 1925-26, N. Rella & Neffe Ban Co., engrs. & contractors, Vienna, Austria, asst. supt. during bldg. of power station and new cutlery works, involving surveying, excavation, concrete and reinforced concrete work, tenders and estimates; Oct., Nov., Dec. 1926, instrumentman for highway dept., Govt'. of Sask.; at present, occasional student, Univ. of Toronto.

References: P. Gillespie, R. W. Angus, E. A. Allcut, C. R. Young.

PATERSON—E. L., of Hamilton, Ont., Born at Euphrasia Twp., Ont., June 14th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1920; 1920 (summer), asst. city engr., Owen Sound, Ont.; 1920-21, engr. i/c constrn., Dept. of Pub. Highways of Ont., for Symonds Constrn. Co.; Univ. of Toronto sessions 1921-22 and 1922-23 in highway lab. under Prof. A. T. Laing; 1923 to date, i/c Hamilton division, road engrg. dept. of Imperial Oil Limited.

References: K. D. McDonald, H. Lumsden, C. G. R. Armstrong, G. Marston, A. M. Jackson, W. J. Fletcher, W. L. McFaul, D. H. Fleming.

PORTUGAIS—JOSEPH MAURICE, of Montreal, Que., Born at Rimouski, Que., Aug. 12th, 1899; Educ., B.A.Sc., C.E.E.E., Montreal Univ., 1924; topography, Que. Streams Comm'n., Montreal (summer); dredging, Public Works Dept., Ottawa, under M. Amiot (2 summers); Shawinigan Engineering Co., under M. Wyman, concrete and erection of disconnect switches; Southern Canada Power, under J. H. S. Wurtele, erection outdoor type substation transmission line survey and constrn.; constrn. of concrete bridges and subway, Water Board, City of Montreal; at present, technical engr., Canada Cement Co.

References: O. Lefebvre, J. S. H. Wurtele, A. Boyer, J. F. Brett, C. J. Desbaillets, A. Frigon, A. Fraser, H. S. Van Scoyoc.

ROGERS—G. H., of Westmount, Que., Born at London, England, July 25th, 1881; Educ., Science and Art Schools, England; 1902-06, constrn. and mtce., National Telephone Co.; 1907 to present time, with Bell Telephone Co. of Canada as, 1907-09, development engr., 1910-12, transmission engr., 1913-16, constrn. engr., 1917-20, rate studies and surveys, 1921 to date, general commercial engr. i/c surveys and rate engrg.

References: A. M. MacKenzie, P. E. Jarman, B. C. Nowlan, W. C. Adams, R. M. Hannaford, W. R. Pearce, H. S. Petford.

ST. JACQUES—ALBERT, of Montreal, Born at Montreal, Dec. 2nd, 1899; Educ., College de Montreal; 3 yrs. Dom. Bridge Co.'s night classes structural design; 1918-22, structural detailing; 1924-25, Shawinigan Water & Power Co., testing and repairing electrical equipment; 1925 to date, Montreal Water Board, studies and design for bridges, hydraulic structures and hydro-electric development.

References: C. J. Desbaillets, J. F. Brett, J. A. Jette, A. Leroux, F. E. Field.

WHITE—EDWIN, of Strathmore, Alta., Born at Wells, England, Nov. 1st, 1897; diploma, Institute of Tech. and Art, Calgary, 1926, Alta. leveller's certificate, Dom. Gov't., 1926; 1924-26, C.P.R.-D.N.R., general levelling instrument work in connection with irrigation practice and structure mtce.; 1926, preparation of field costs, 4 constrn. camps and general office work incidental thereto; at present, asst. to field engr. in charge.

References: E. N. Ridley, G. H. Patrick, C. C. Richards, S. J. Davies, R. M. Dingwall, J. H. Ross, F. B. Young.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

CARTER—HUGH CLAY, of Belize, British Honduras, C.A., Born at Clapham, England, Feb. 5th, 1884; Educ., St. Albans School; 1906-10, constrn. dept., C.P.R., Winnipeg, dftsman, instman, etc.; 1911-14, res. engr. of constrn., C.P.R., Winnipeg; 1914-19, war service, C.E.F.; 1919-20, res. engr. of constrn., C.P.R.; 1921-23, asst. engr., Public Works Dept., British Honduras Gov't.; 1924 to date, director of public works, under colonial office, to the Gov't. of British Honduras.

References: W. A. James, T. C. McNabb, C. D. Mackintosh, A. E. Stewart, A. E. Sharpe.

RYAN—EDWARD A., of Montreal, Que., Born at Montreal, Jan. 1st, 1891; Educ., B.Sc., McGill Univ., 1912; 1909 (summer), surveying, City of Westmount; 1910-11 (summers), testing elect'l equipment, M.L.H. & P. Co.'s shops; 1912-13, engrg. dftsman on mechanical and elect'l work on bldgs., Ross & Macdonald; 1913-15, engr. i/c design systems of heating, ventilation, plumbing, electric wiring, telephones, steam plant, etc., for Ross & MacDonald; 1915-17, supervising work similar to foregoing for R. J. Durley, C.E.; 1917-18, i/c office of R. J. Durley engaged on design and supervision of central heating and steam plants, also investigations and reports on heating and ventilating systems, etc.; 1918-19, tech. asst. to ch. of metallurgical division, aviation purchasing section, French High Commission, N.Y.; 1919-20, engr. engaged on design of heating and ventilating system of new paper machine room and steam plant for Laurentide Co., Grand'-Mere; 1920 to date, in practice as consulting engr.

References: R. J. Durley, F. A. Combe, J. L. Busfield, W. C. Adams, O. O. Lefebvre, H. A. Terreault.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

GOODWIN—EDWARD MANSEL CAREY, of Raleigh, N.C., Born at Baie Verte, N.B., May 8th, 1894; Educ., Queen's Univ., 2 yrs.; 1912 (summer), rodman, Que. & Sag. Ry.; 1914-19, lieut., 2nd C.M.M.G. Bdge. O.S.; 1919, 3 mos. leveller, N.S. Highway Board; 1920-21, instrumentman, Riordon Co. Ltd.; 1921, bridge engr. and i/c work for Edgar Irvine Ltd., Alexandria, Ont.; 1922, built steam plant and laundry and installed machinery for N.C. State Sanatorium at Sanatorium, N.C.; 1923 to date, ch. of party locating high power transmission lines, general engrg. work, for Carolina Power & Light Co., Raleigh, N.C.

References: G. L. Freeman, E. S. M. Lovelace, H. T. Routley, C. G. J. Luck, A. S. Cook, G. C. Parker.

HIGGINS—THOMAS JAMES, of Montreal, Que., Born at Fitchburg, Mass., Jan. 2nd, 1899; Educ., I.C.S. course in Mech. Engrg., grade and high school and business college; 1916-17, detail dftsman and design of details for lathes, planers, boring mills, etc., for Manning-Maxwell & Moore, Fitchburg; 1918-19, designing and layout dftsman in heating, ventilating, drying and air conditioning dept. of B. F. Sturtevant Co., Boston, Mass.; 1920-22, with same Co.; 1920, checking engrg. and design of dftsmen on same work; 1921 (first part), checking of engrg. design and apparatus for sales engrs. in 26 branches and foreign offices and issuing of instructions, drawings, etc., to drawing room and shop for bldg. of machinery and equipment; 1921-22, transferred to New York office as asst. dist. mgr. in charge office and engaged on similar work; 1923 to date, with Ross Engineering Co. of Canada as vice-pres. and mgr. i/c activities in designing, bldg. and installing for paper industry, air systems for heating, ventilation, air conditioning, etc.

References: B. R. Perry, J. T. Farmer, J. Stadler, E. A. Briner, A. Buchanan, A. A. MacDiarmid, H. S. Taylor, S. W. Slater.

McKILLOP—VERNON ARCHIBALD, of London, Ont., Born at West Lorne, Ont., March 12th, 1899; Educ., B.A.Sc., Univ. of Toronto, 1924; Sept. 1919-June 1920, transformer test and armature winding depts., Westinghouse Electric & Mfg. Co., Pittsburgh; May to Sept. 1921, operator, H.E.P.C., St. Thomas; July to Sept. 1923, electrical dept., Willys Overland Co., Toronto; 1924-1926, asst. engr., Public Utilities Comm'n., London; 1926 to date, engr., Public Utilities Comm'n., London.

References: J. R. Rostron, E. V. Buchanan, W. P. Near, W. M. Veitch, F. Ball.

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Modern Mercury-Arc Power Rectifiers

Their Uses and Application in Converting Alternating to Direct Current

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Modern Mercury-Arc Power Rectifiers

Although alternating current has many great advantages, it is well known that there are numerous fields with great possibilities for the use of direct current, some of which are: trolley lines, subways, main line railroads, special drives and electrolysis. It is usually disadvantageous to produce the power required for these purposes by means of direct current generators, and, furthermore, it is often uneconomical to transmit direct current over a long distance. An efficient use of direct current is therefore possible only by distributing the power by means of high-voltage alternating current lines and converting it at or near the site of application into direct current. So far, this has been done for power purposes of the above-mentioned character by means of rotating converters of the following types:—

Motor-generator sets, which consist of two separate machines, namely, a motor driving a direct current generator. The performance characteristics of such a set depend on the characteristics of the individual machines which constitute it, and the efficiency is the product of the efficiencies of the two machines.

Synchronous converters, or rotary converters, which are a combination of a synchronous machine and a direct current machine having a common armature and field structure.

Cascade converters, or motor converters, which are combinations of an induction motor with a synchronous converter, the second circuit of the former feeding directly into the armature of the latter.

Glass-bulb rectifiers, as well as the electrolytic, thermionic, and mechanical or vibrating rectifiers, are not built for large power outputs.

The most recent device for converting alternating into direct current is an outgrowth of the glass-bulb rectifier commercialized twenty-five years ago, the principle of which is well known. The present-day development of the power rectifier, as it is usually called to distinguish it from the glass-bulb type, utilizes transformers with a larger number of phases and special connections, as well as metal tanks. The adoption of these made a number of things possible, such as efficient cooling of the tank by means of water and the use of a greater number of anodes and therefore a larger power output. However, it also introduced difficulties which at that time seemed unsurmountable.

The difficulties in the commercial development of the rectifier for large capacity outputs were due to conditions arising from the necessity of using containers suitable for capacities in excess of those possible with glass containers. Among these difficulties may be mentioned uncontrolled mercury-vapour arc phenomena, the obtaining and maintaining of an air-tight sealing of the anodes and the cathode in the container, as well as their insulation from it. In a glass-bulb rectifier the bulb itself is an insulating material, and sealing could easily be accomplished by fusing the wire into the bulb. Both of these difficulties have been overcome, which has made possible the growth of the metal-enclosed mercury-arc rectifier.

Installations on a commercial scale were begun in Europe in 1912, and then in capacities of less than 100 kw. output. One of the earliest installations is shown in figure No. 1, for an interurban trolley line. About 1915, such perfection of detail had been effected that a general application of rectifiers began and has continued at an increasing rate each year, except for a short period due to the effect of the war, as can be seen from figure No. 2. The lower curve in this figure gives the total capacity of the rectifiers

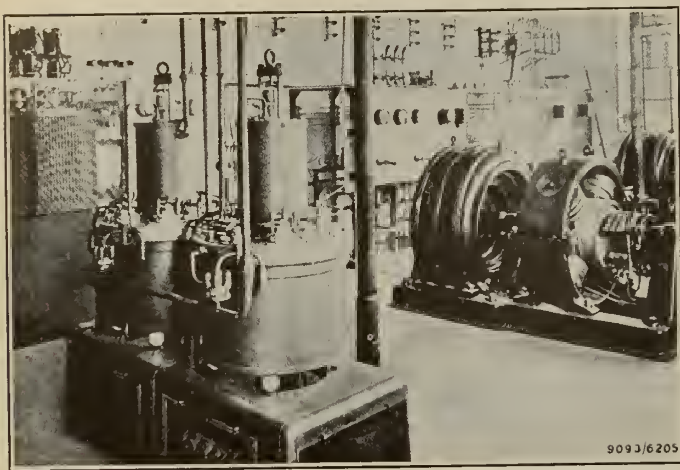

Figure No. 1.—First Large Installation of Power Rectifiers.

installed in each year for railway service, including tramway as well as main line railroad electrification, and it can be seen that in 1925, for instance, 80,000 kw. were sold for railway service. In figure No. 3 is illustrated the increase of capacities for which such metal-enclosed rectifiers were built, for 600 volts and for 1,500 volts. In figure No. 4 is shown the increase in the voltages on the direct current side, successfully used with rectifiers during the past fifteen years. All three of these graphs show that especially during the last five years, i.e., in the period from 1920 to 1925, an astonishing broadening of the field of application of such rectifiers has taken place. It can clearly be seen, from figures Nos. 3 and 4, that much can be expected in the future, not only in increases in the capacity but also in higher voltages, and that this device will keep pace with the general progress in these two respects.

Up to the present there have already been installed more than 460 rectifier plants with more than 950 rectifier tanks of one make alone, of a total capacity of over 460,000 kw. The total output of all rectifiers installed by European manufacturers to date is approximately 600,000 kw.

A standard type rectifier with vacuum pump is shown in figure No. 5. This unit has a rated capacity of 1,500 kw. at 1,500 volts. Its overload capacity is 2,250 kw. for fifteen minutes, 3,000 kw. for five minutes and 4,500 kw. for one minute.

Several large installations for rolling mills were recently completed in Europe; the largest of these, in Belgium, have a rating of 2,000 kw. and 2,400 kw., respectively. The Dutch State Railways have installed seven substations whose total capacity reaches the very considerable figure of 27,000 kw. at 1,500 volts. The substations' ratings are 3,000 kw. and 4,500 kw., respectively, and most of them are entirely automatic in their operation.

In addition to these high-capacity installations at comparatively low voltages, there might be mentioned several high-voltage installations which have been in successful operation for several years: a 2,300-volt, 1,000-kw. substation for the London, Midland and Scottish Railway; a 3,000-volt, 1,700-kw. installation for the Italian State Railways; and the rectifier with the highest direct current voltage in the world, that of 4,000 volts at 1,000 kw., which takes care of the entire twenty-five miles of the Torino-Lanzo-Ceres Railway in Italy. This last is illustrated in figure No. 6.

An installation which shows how easily rectifiers lend themselves to almost any location is a station of the Chemin de fer Metropolitain of Paris. The complete equipment is mounted on one of the platforms of a subway station, without any structural changes whatever having been made in the station. (See figure No. 7.)

Probably the two factors which appealed most to those responsible for the early acceptance of the rectifier were the high efficiency at all loads and the minimum of attendance required. Both of these factors are immediately reflected in the operating accounts, and in some instances in so pronounced a manner as to establish large credits towards amortization of the replacement investment where the rectifier was brought in to modernize a substation and supplant rotating machinery of early design. Especially is this so where machinery employed for conversion is operated under conditions which imposed a low annual load factor, as in the supply of direct current power to rolling mill drives, elevators, dredge drives, mine, street railway and heavy electric traction haulage, etc.

The confidence which is placed in this device in Europe is probably best illustrated by the fact that the Berlin Rapid Transit recently placed one order for ninety-five rectifiers of a total capacity of more than 114,000 kw. continuous load and 228,000 kw. overload for the entire electrification of a belt line interconnecting all the suburbs of the city.

Elementary Theory of Alternating Current Rectification

It has been known for more than forty years that if a source of alternating current is connected to two electrodes,

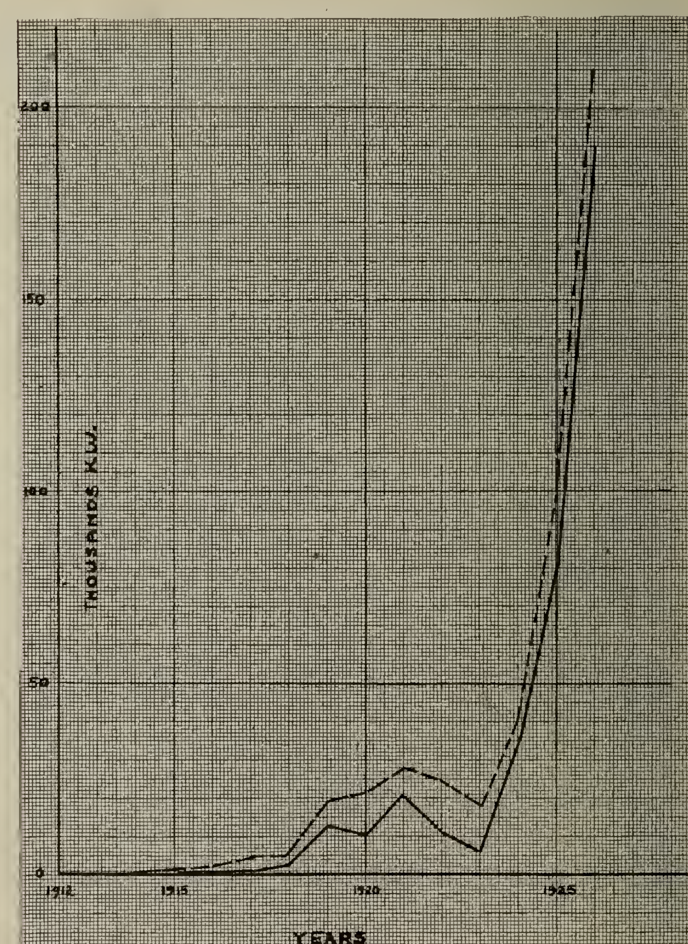

Figure No. 2.—Yearly Production of Brown-Boveri Type Rectifiers, Showing Total Capacity in Kilowatts.

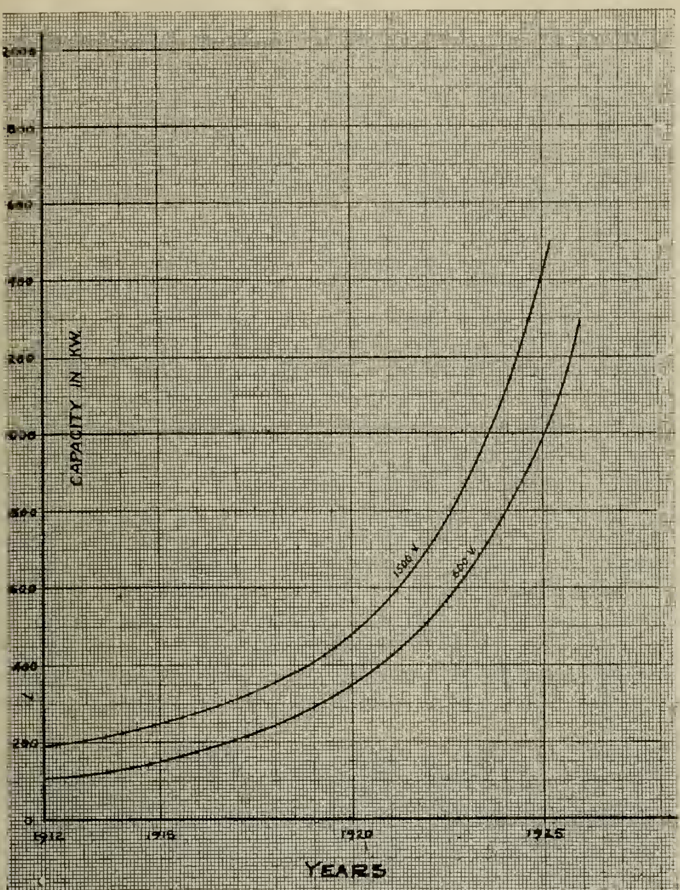

Figure No. 3.—Maximum Ratings of 600-Volt and 1,500-Volt Rectifiers in Various Years.

one of which is mercury, and the space between the electrodes is evacuated, a valve action is obtained, so that if a sufficiently high potential is impressed upon these electrodes a unidirectional flow of current results from anode to mercury cathode. A single-phase rectifier has several well-known disadvantages; first, only half of each cycle of alternating current voltage can be utilized; second, there is no provision for maintaining the arc during periods of reversed voltage; third, the resulting direct current is very uneven. The effect of using polyphase connections,—more than two anodes,—can be seen very clearly on the right-hand side of figure No. 8. In the case of a two-anode connection, as shown on the left-hand side of figure No. 8, it can be seen that for this arrangement both halves of the wave are utilized. This means that the current will flow in the same direction through the secondary circuit with reference to the load resistance.

Due to the inherent inertia of reactance, which is a characteristic of every electric circuit, both anodes are active for a short fraction of a cycle, and the arc is transferred from one anode to the other without interruption of current in the load circuit, because enough energy is provided to maintain a voltage according to the law of induction to carry the arc over the zero period of the voltage wave. In the case of a three-phase connection with three anodes, it may be assumed that at any instant only that anode is active whose potential with respect to the cathode is the highest, and much less pronounced undulations will be found in the direct current than with the two-anode connection. An arrangement with six, twelve or even twenty-four anodes will give an even better form of the direct current.

With small battery-charging rectifiers the arc is "struck" by tilting the container to establish a physical electrical connection between the cathode and an anode. Obviously, this could not be done with large power rectifiers because of size and weight. Other arrangements had therefore to be developed for this purpose. Figure No. 9 is a schematic diagram of connections, illustrating an arrangement for "striking" the arc and for maintaining it during periods of low current, which is connected to an auxiliary source of current supply and resembles the connections of a two-anode rectifier. The arc is "struck" as soon as the starting anode is withdrawn from the cathode, producing ionized mercury vapour in the container to establish an arc between the cathode and the maintaining anodes. This operation puts the plant into condition for immediately picking up the load.

The potential drop in the arc between the anodes and the cathode is about 20 volts. The losses due to starting and maintaining the auxiliary arc are negligible for tanks of larger capacity. A peculiarity of this arc is that the voltage drop remains practically constant for any current and any direct current voltage. This shows immediately the reason why such a type of rectifying device has a very high efficiency at higher voltages. Assuming a direct current potential of about 20 volts, the losses would be 50 per cent, or an efficiency of 50 per cent. For 200 volts, the efficiency would be 90 per cent; for 2,000 volts, 99 per cent. For higher voltages the efficiency becomes practically 100 per cent. These percentages apply to the rectifier alone.

In figure No. 10-A are shown the overall efficiencies, including the rectifier, transformer and auxiliary apparatus for various voltages. The overall efficiencies over the whole working range for rectifiers of 600, 1,500, 3,000 and 5,000 volts are shown in figure No. 10-B. It might be well to note here the fact that this efficiency drops very little at partial loads. Were it not for the increase of losses in transformers at overloads and at partial loads the overall efficiency of a rectifier would be practically constant at all load conditions.

Another outstanding advantage of the rectifier is the simple and quick process of starting, which is easily comprehensible by reference to the foregoing. In commercial practice the arc is "struck" and the rectifier brought to full capacity operation in a short space of time. It can readily

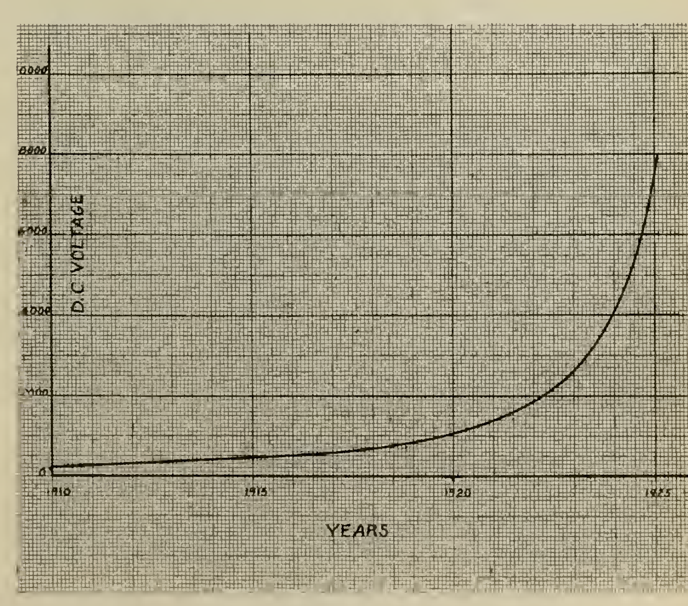

Figure No. 4.—Maximum Direct Current Voltages of Rectifiers in Various Years.

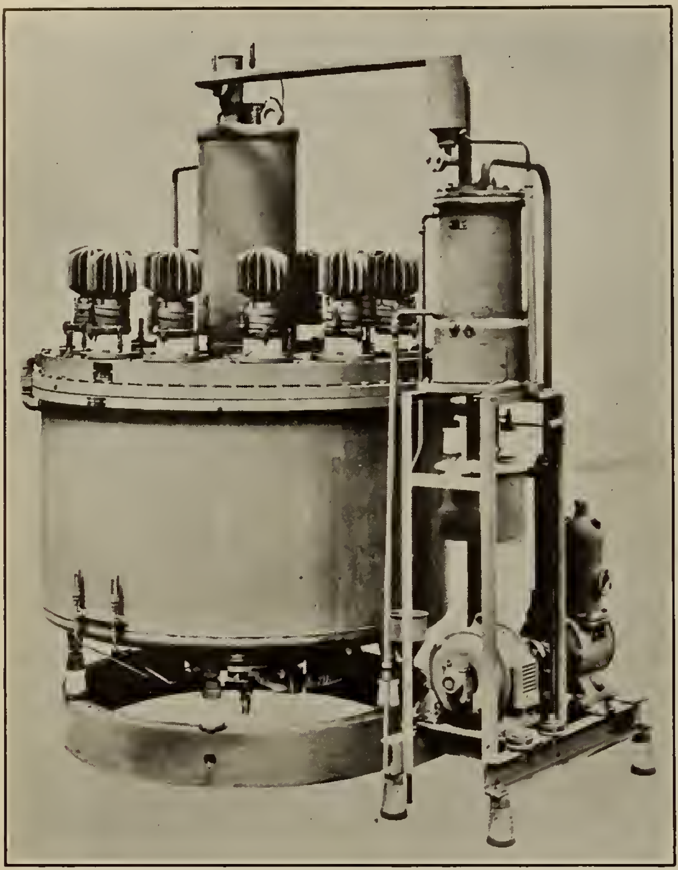

Figure No. 5.—One of the Larger Types of Modern Power Rectifiers.

be realized that from the time the operator closes the starting circuit,—whether by operating the main circuit breaker mechanically interlocked with the starting switch, or separately, or automatically,—until the rectifier can be connected to the line, only a second or two need elapse. Moreover, no mistake can be made by the operator because the actions are made to take place in the proper sequence.

There is one other thing which has to be considered in a modern rectifier, and that is the vacuum in the container. Thus far it has been noted only that the container has to be kept sealed. The reason for this is to maintain the degree of vacuum necessary for the proper functioning of the arc.

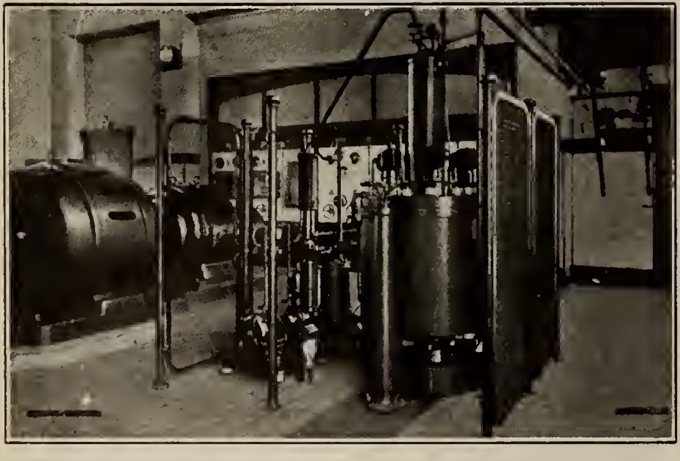

Figure No. 6.—Installation of Rectifier with the Highest Direct Current Voltage.

It was an easy matter to design a vacuum pump for this purpose, and no difficulty has ever been experienced with this part of the apparatus. The pump is permanently connected to the tank of the rectifier by means of an air-tight pipe, as shown in figure No. 9. However, the part which required a great deal of work and development before it reached its present state of perfection was the continuous-reading vacuum meter.

Figure No. 11 is a diagram of connections for a fully automatic vacuum maintaining equipment. The vacuum pump is driven by a small motor connected to an auxiliary circuit. Its controlling relays are connected to a contact voltmeter. The contact voltmeter is energized by means of two windings placed at right angles to each other and located at the bottom of the instrument. These two windings are connected to the hot-wire element, which in turn is connected to the pipe joining the vacuum pump and the rectifier container. The principle of this gauge is that the thermal conductivity of gases depends on the pressure of the gases. As soon as the pressure changes, the Wheatstone bridge consisting of the four wires, shown in figure No. 11, becomes unbalanced and therefore the contact voltmeter is affected. Should the vacuum drop to a low value, its moving part establishes a circuit through the left-hand contact and the closing coil of the circuit breaker controlling the vacuum pump motor is energized, thus putting the pump into opera-

Figure No. 7.—Rectifier Installation, Mounted on Platform of Subway Station.

tion. After the vacuum has been increased to a certain value, the Wheatstone bridge again affects the voltmeter so that the circuit is established through the other contact, on the right-hand side, thus stopping the vacuum pump.

This arrangement works entirely automatically and therefore the station attendant does not have to look after it, except for an occasional inspection. The only operation necessary to connect the rectifier with the line is to close the main circuit breaker.

In order to maintain vacuum in the cylinders several arrangements have been developed, the most successful of which is the employment of mercury. This arrangement has many advantages:—first, it seals perfectly; second, it can very easily be inspected should leakage develop; and, third, leakage, as soon as detected, can be eliminated by a mere tightening of screws. In all other arrangements so far developed, the main disadvantage has been the inability to maintain the joints tight for any reasonable time. Furthermore, in none of the other arrangements can leakage be

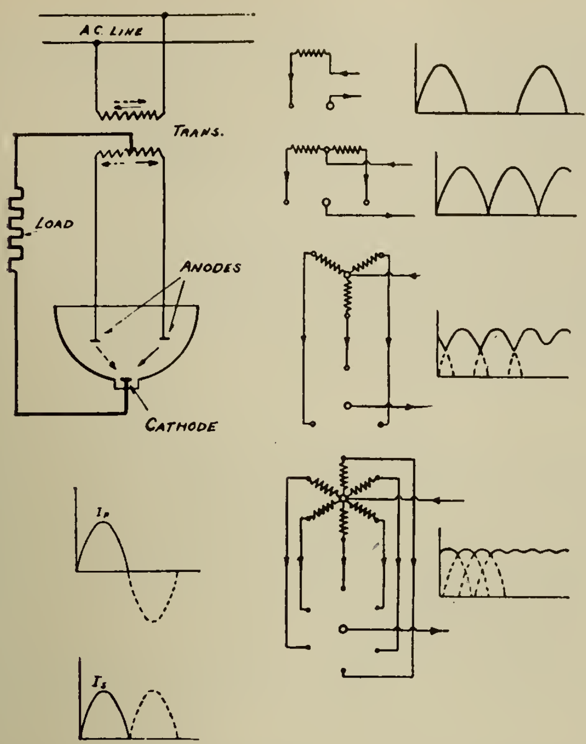

Figure No. 8.—Elementary Diagram of Rectification and Forms of Direct Current Obtained with Various Transformer Connections.

detected; the vacuum may drop, and the attendant may be unable to determine the cause, while with the mercury arrangement inspection will immediately show the location of the fault. Moreover, should mercury leak through into the interior of the container, no harm is done, as it will merely be added to the mercury in the cathode.

As pointed out, one of the factors which brought the rectifier to its present advanced state of perfection and which makes it competitive with rotary converters in size, voltage regulation and price, was the development of a polyphase transformer with special connections, permitting the desired performance characteristic as well as greatly increased capacity.

The rectifier transformer differs from the standard power transformer, not only in respect to connections, but also in the provision for certain electro-dynamic forces which made it necessary to provide different mechanical construction. In figure No. 12 is shown a standard rectifier transformer for 3/6 phases. The coils of these transformers are kept under a certain pressure by means of a specially designed support. It can be seen that the cast steel pressure rings at the top of the coils are pressed down by springs, thus forming a solid unit.

Comparison of Mercury-Arc Rectifiers and Rotary Converters

It is difficult to put both types of apparatus on a strictly comparative basis regarding load, space needed and price. Due to the fact that the rectifier has a very low thermal capacity, its overload capacity is relatively small for longer periods, while on the other side the overload capacity is higher for momentary and relatively short periods. This is principally due to the absence of current-collecting parts.

From the efficiency curves shown in figure No. 10, it is obvious that as soon as the potential rises above 600 volts there is a very great advantage in favour of the rectifier. Although the efficiency of a 600-volt rectifier set at full load is about the same as for a rotary converter set at full load, the difference in the efficiencies of these two types of equipment becomes very noticeable at partial loads, which can be seen from figure No. 13. The difference in the converting losses for these two types of equipment is represented by the shaded area at the bottom of the figure for a load distribution as given in the middle section.

The costs of operation and maintenance of a rectifier are somewhat less than for other types of conversion apparatus. Moreover, the scheme of control is very much simpler than with any of the well-known methods for starting converters. From the outline of the starting procedure of a rectifier and considering the above, it will be appreciated that the adaptability of the rectifier to automatic control is generally greater than that of the synchronous converter. Another advantage is the fact that practically no noise is produced, except the occasional cut-in of relays and breakers and of the pump, which is negligible, since there is very little rotating mass.

In congested districts, where it may be necessary to install a conversion unit in the basement of the building, satisfactory ventilation for converter installations is usually obtained only by resorting to elaborate and extensive alterations, involving air ducts, fans, filtering systems, etc.

As mentioned above, the rectifier losses are dissipated by water cooling, and therefore the removal of the heat outside the rectifier room is a relatively easy matter. The problem is about the same as with a water-cooled transformer. The simplest cooling scheme is to use tap water, or, if that is not available, or too expensive, a well or spring could be utilized. There are also closed-cooling methods, in which the water is cooled by a fan and recirculated.

In regard to floor space requirements, it might be said that a 600-volt rectifier installation requires about the same space as a comparable synchronous converter installation.

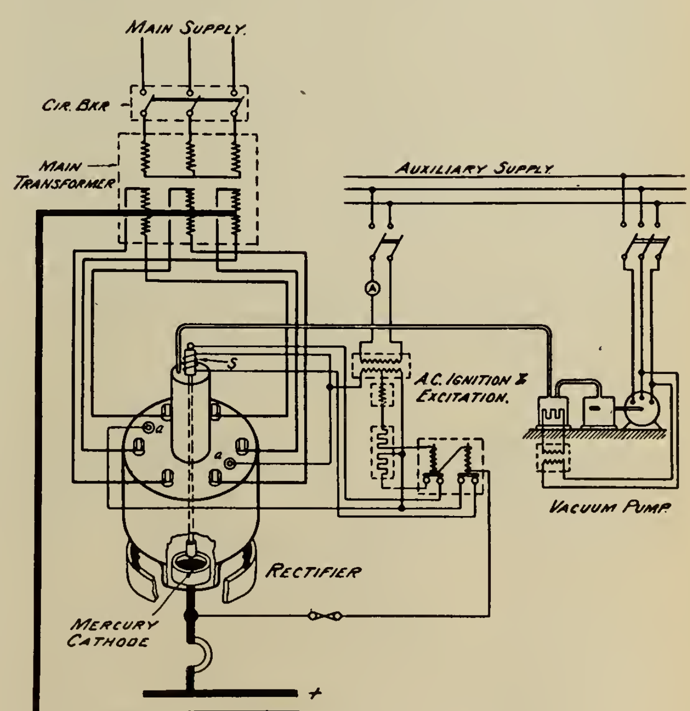

Figure No. 9.—Schematic Diagram of Connections, Showing Starting and Maintaining Equipment as well as the Vacuum Pump Arrangement.

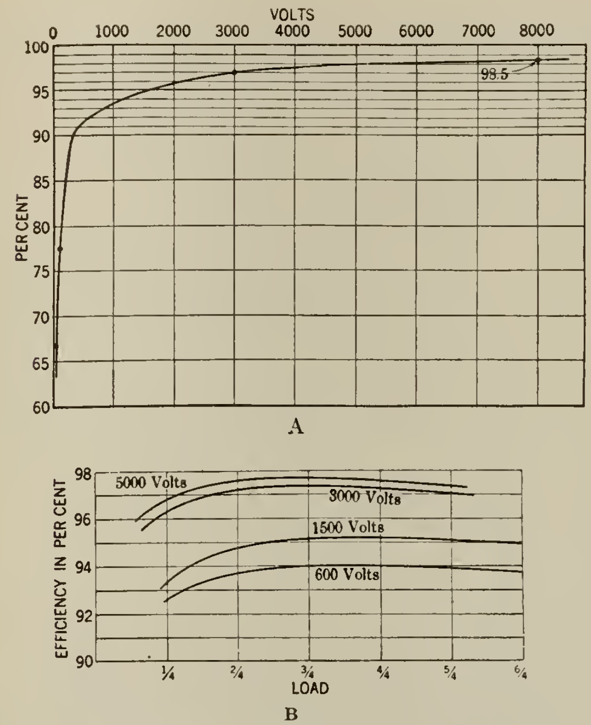

Figure No. 10.—Overall Efficiencies of Rectifier Plants of Various Voltages.

For high voltages the rectifier installation requires less space. However, it must be kept in mind that due to the light weight of the equipment, and due to the absence of rotating parts, practically no foundations or other special building construction is necessary. Furthermore, the various parts of the equipment belonging to a rectifier installation can be distributed and placed in more advantageous locations than with rotary converter installations, permitting a fuller utilization of the available space. This fact is very well illustrated by figure No. 7, showing the rectifier placed on the platform of a subway, and by figure No. 14, which shows the transformers located in the basement and the rectifiers on the floor above, with some of the auxiliary apparatus, as vacuum pump, etc., allowing a good utilization of the space by distributing the equipment on different floors of a building. In figure No. 14 it can be seen that for

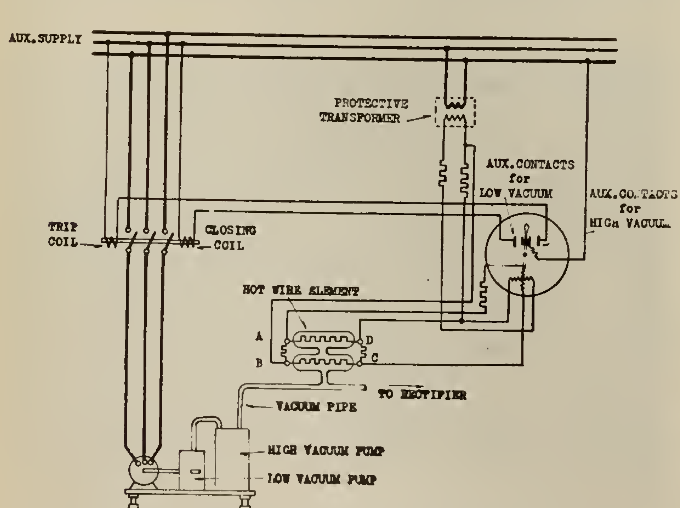

Figure No. 11.—Schematic Diagram for Automatic Control of Vacuum Pump with Novel Hot-Wire Vacuum Gauge.

a rectifier installation far less unoccupied space is necessary, particularly in the height of the room in which the rectifiers are housed. This might be a material advantage in congested districts where special attention would have to be given to the layout.

One example of the above mentioned fact is that of an elevated railroad passing through the heart of a large city, where it was necessary to place the converting units at the points of highest traffic peak loads in order to eliminate the feeder cables and secure the highest economy of operation. This was accomplished by placing the rectifiers in the arches of the elevated structure, a procedure which would have been impossible with any other type of converting unit.

Special Advantages of Rectifiers for Railway Service

In figure No. 13 is illustrated the saving obtained with mercury-arc rectifiers due to their high efficiency at partial loads. That the saving due to decreased conversion losses will be considerably more for higher voltages can readily be appreciated from this efficiency curve, where the saving is not only at partial loads, but at all load conditions, and to a very pronounced degree.

Due to the fact that the rectifier has an ampere rating rather than a watt rating, and since the losses in the arc are practically the same for any direct current voltage, this device lends itself admirably as a high-voltage converter. Not only does its efficiency increase with higher voltage, but also the capacity per container, and this without any alterations of importance, up to 5,000 volts direct current. The limited use of direct current for heavy traction work has been largely due to the fact that no efficient converting

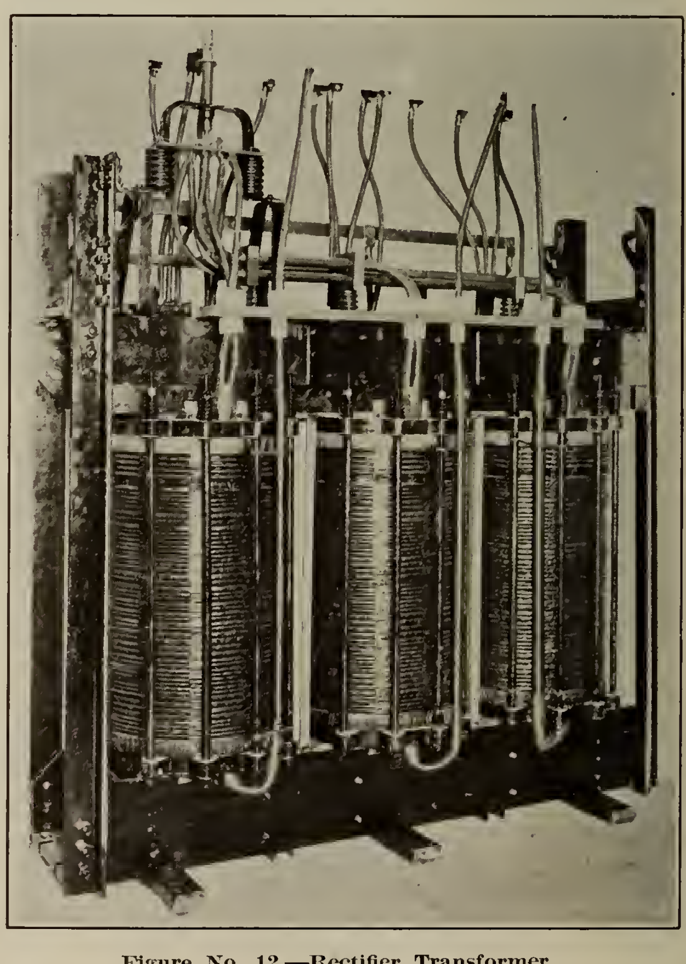

Figure No. 12.—Rectifier Transformer.

device for high voltages was available. Heretofore, 1,500-volt direct current conversion was likely to be considered critical from the point of view of the converting device, except in the case of motor-generator sets. Above that voltage, the use of a synchronous converter was out of question, and the problem could be solved only by the use of motor-generator sets, which involved a great sacrifice in efficiency and in cost.

In order to bring out the main advantages, an electrified line with a 3,000-volt direct current system will be considered. This voltage cannot any longer be considered high with reference either to rolling stock or catenary equipment, as is well demonstrated by railway electrifications for this

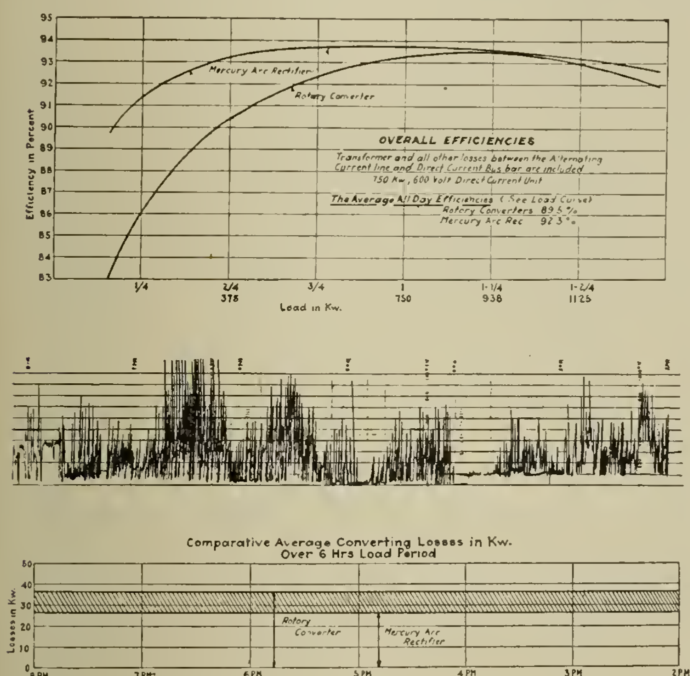

Figure No. 13.—Efficiency of a 600-Volt, 600-Kw., Rotary Converter and Mercury-Arc Rectifier; Load Chart; Performance Chart.

voltage both on this continent and abroad. The main advantages are:—

First, the converting equipment is about half the cost of a motor generating set,—which is the only other conversion device which can give such high direct current voltages,—and even less, as a saving will also be effected due to simpler substations and simpler control equipment.

Second, elimination of practically all feeder cables, because the rectifier can be located at points with the heaviest load peaks. Furthermore, centralization of the converting equipment is not necessary. The reason for this is largely due to the fact that the control equipment and the substations necessary to house a rectifier are less complicated and cheaper than for motor-generator sets.

Third, smaller losses in trolley lines, since a greater number of substations with closer spacing do not materially affect the cost of electrification. This is due to the same reason as mentioned above.

Fourth, doing away with special control devices, supervisory equipment, etc., since rectification at high efficiency is made possible at all loads, and therefore floating on the line of rectifiers does not impair the economic aspects of the rectifier installation. Control can be easily accomplished by a simple device, as, for instance, by a time-switch which would connect or dis-

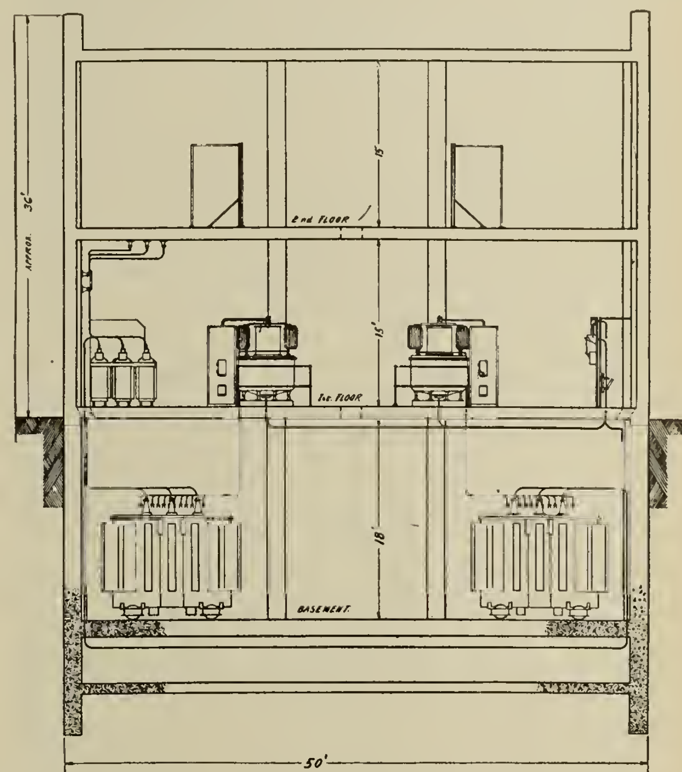

Figure No. 14.—Typical Rectifier Substation Layout.

connect, respectively, the rectifying sets from the trolley line at certain predetermined intervals.

Most of the above mentioned high-voltage direct current electrifications employing mercury-arc rectifiers as a conversion device were the result of studies taking into account the above considerations. Rolling stock for voltages of 3,000 and 4,000 volts has proven to give full satisfaction in practical installations, both on this continent and abroad.

The writer is fully convinced that in the not far distant future the rectifier, with its extreme adaptability to higher voltages, will revolutionize the electrification programmes as well as the system questions so long discussed in every country.

Discussion on Modern Mercury-Arc Power Rectifiers*

Mr. M. L. de Angelis.

Mr. de Angelis remarked that the mercury-arc power rectifier was now an industrial apparatus, with at least seven years of satisfactory operation behind it, and had shown itself just as reliable as rotary converters or motor-generator sets.

All engineers who had had experience with railway sub-station converting apparatus would agree on the fact that the simpler it is the better, and there could be no doubt that the mercury-arc rectifier fulfilled this requirement in a greater degree than any rotating and commutating machine. It should be noted, however, that the 60-cycle rotary converter had been greatly improved during the last decade, and, with the use of flash-barriers, high-reluctance commutating poles, and, above all, with the adoption of high-speed circuit-breakers, it was now possible to make several consecutive short-circuits on 600- and 750-volt machines without any flashing. He had made thirty consecutive short-circuits at intervals of one minute on a 750-volt converter for use on 1,500-volt sets and obtained remarkable results, but could not make the same statement for converters giving 1,500 volts directly on one machine.

Having had the opportunity of examining, while in operation, the two 540-kw., 600-volt rectifiers of the Metropolitan Railway of Paris, which had been running quite satisfactorily since early in 1923, he could say that they stood high overloads while feeding a section of the most important subway line of Paris, carrying a high peak load at rush hours. The headway between trains was 90 seconds and each train took 1,800 amperes at starting current. Several trains could start simultaneously in a section.

This installation was considered as a trial, and, obviously, the Metropolitan Railway Company did not want to go into the expense of a building to house the apparatus, so they decided to have it erected on a part of one of their passenger station platforms. This was done with satisfactory results, and proved how easily rectifiers could be accommodated, even in restricted quarters, and that they did not need special costly foundations.

In Europe, the general consensus of opinion was one of complete satisfaction with mercury-arc rectifiers; he did not see any particular reason why it should not also be so in Canada.

Their good efficiency at practically all loads, together with their simplicity in starting and running, made the rectifiers very well suited to automatic operation, and their use should be seriously considered when studying new railway substations for surface or underground lines.

It was interesting to compare the weights of a rotary converter and a mercury-arc rectifier installation. For example:—

Apparatus	Net weight
1,200-kw. rectifier set, consisting of two tanks, one vacuum pump and necessary vacuum piping	10,300 lbs.
Transformer without oil	14,500 "
Oil for transformer	6,700 "
Total	31,500 lbs.
or 26.25 lbs per kw.	
2,000-kw. rotary converter, complete	56,800 lbs.
Three transformers with oil	29,130 "
Total	85,930 lbs.
or 42.9 lbs. per kw.	

It could be seen from the figures giving the weight per kilowatt that rectifiers had the advantage over rotary converters from the point of view of weight. Since a rectifier was a stationary piece of equipment, a simple and cheap foundation was all that is necessary for mounting it.

The recent important decision arrived at after several years of careful study by the engineers of the Berlin Metropolitan Railways was very significant, and spoke well for the mercury-arc rectifier. He hoped that complete information on the theory and working of the mercury-arc power rectifier would soon be published in book form by those engineers who have been responsible for its development. Perhaps the author would find it possible to favour us with such a useful and much-needed book.

Mr. A. J. Westman.

Mr. Westman desired further information on the following points:—

1. The difficulties to be expected in the parallel operation of mercury-arc rectifiers and compound-wound direct current apparatus. Is the regulation of the mercury-arc rectifier altered to meet the characteristics of the direct current apparatus, or are the characteristics of the compound-wound direct current apparatus altered to suit the rectifier?
2. The suitability of the mercury-arc rectifier for high-voltage main line railroad electrification. Comparative efficiencies of rectifiers and motor generators.
3. Nominal rating of rectifiers as compared with rotary converters.

Mr. H. G. Owen.

Mr. Owen had noted that the author had made no reference to interference with communication circuits and,—due to the arc,—with radio. He asked whether some data on these matters could be given.

Mr. C. J. Desbaillets, m.e.i.c.

Mr. Desbaillets observed that the author had given us very valuable information on the operation of the rectifier itself. It could be seen that it was not possible to furnish any wattless current back to the net-work with a rectifier, and thus to correct the power factor. He would ask to what extent power-factor correction entered into the operation of converting devices, and whether the lack of such correction with rectifiers might not be an argument against the installation of rectifiers in certain instances.

Mr. F. T. Kaelin, m.e.i.c.

Mr. Kaelin thanked the author for his very complete paper, and thought that it would be interesting to have some comparative data as to the cost of rectifier and rotary converter installations.

Mr. K. B. Thornton, m.e.i.c.

Mr. Thornton remarked that in the very near future two new mercury-arc rectifier substations would be put into operation in this country; one of them by the Montreal Tramways Company, rated at 2,400 kw. full-automatic; and one at 600 kw., manually-operated set, at Three Rivers.

In the discussion, mention had been made of the efficiency of rectifiers as compared to rotary converter or motor-generator sets. In his opinion, the value of a rectifier could only be properly estimated if the saving in maintenance and attendance were also taken into account. The diagram of connections, figure No. 9, gave an idea of the simplicity of the auxiliary apparatus necessary to make a station full-automatic, since a rectifier need not be brought up to speed during starting, or need its polarity be checked.

* This discussion took place following the presentation of the paper by the author at the meeting of the Montreal Branch of The Institute held on January 13th, 1927.

Evidently, therefore, a large saving was realized in the automatic equipment, and, moreover, far better operation would be ensured, due to the simplified arrangements and the doing away with numerous relays and auxiliary devices.

Mr. O. K. Marti.

The author in reply, referring to Mr. Westman's questions, stated that it must be kept in mind that mercury-arc rectifier equipment would have a constant voltage characteristic were it not for the voltage drop in the transformer. The voltage regulation of a rectifier set could therefore be made to fall within certain limits by a proper design of the transformer. The normal voltage characteristic of a transformer is drooping, and if, therefore, parallel operation with a flat-compounded, or over-compounded, rotary converter set were desired, the only solution was to shunt the compound winding of the rotary converter; in other words, to make the voltage regulation of the converter somewhat drooping also. A standard design of rectifier transformer produced a direct current voltage regulation of 5 to 9 per cent, as desired. It was, however, possible, with a special arrangement, to make a rectifier installation flat-compounded, or over-compounded, just like a rotary converter set. Several such sets had been built more than twelve years ago, but were never put on a commercial basis, as the tendency in Europe was to do away with flat-compounding, or over-compounding, as was beginning to be the case here also.

Personally, he could not see any advantage in an over-compounded machine, but was convinced of the many advantages of a drooping characteristic. Such a characteristic guaranteed far more flexible operation and a much better distribution of the load between neighbouring substations, thus giving the same service with a lower station capacity, and resulting in a better load factor as well as smaller losses in the feeders. It also did away, even under the most extreme load conditions, with a load-limiting resistor.

Regarding the suitability of mercury-arc rectifiers for high-voltage main line railroad electrification, he believed that due to the fact that the rectifier lends itself very easily to a relatively high direct current voltage, up to several thousand volts, it would seem that high-voltage power rectifiers would to some extent settle the long discussed question of what system should be adopted for main-line railways. A rectifier gave the same safety of operation as a motor-generator set,—which was otherwise absolutely necessary for voltages of several thousands of volts,—with less than half the cost of such a set. In addition to this, the efficiency of such a converting device was extremely high as compared to that of a motor-generator set.

In regard to nominal rating, it must be kept in mind that the rectifier could not be brought to a strictly comparable basis with a synchronous converter, on account of the inherently different thermal characteristics of the two devices. The nominal rating, or two-hour rating, of the rectifier was for practical purposes a continuous rating, on account of the low thermal capacity, whereas the synchronous converter had a somewhat higher thermal capacity. However, a converter of modern design with forced ventilation had such a small thermal capacity that an appreciable temperature rise would take place even at a small overload extending over only a short time, and it was therefore necessary, in order to meet the overload of 50 per cent at present required by the Standards of the American Institute of Electrical Engineers, to underrate the machine for continuous load if the nominal rating were asked for,—a course which he considered very arbitrary.

With reference to the question of Mr. H. G. Owen on interference, he desired to call attention to figure No. 8 in the paper, from which it could be seen that the current and voltage waves could be flattened by using polyphase rectifiers. The question of interference was not only a matter of the amplitude of the ripples, but also a function of their frequency, in the same way as with rotary converters or other power-producing devices which give rise to higher harmonics. With regard to radio interference, it might be said that no such phenomena, due to the arc in the rectifier, could be observed. The rectifier arc was, as far as measurements showed, unable to emit radio waves like an arc in air. The phenomena involved in an arc in vacuo and in air were so different that this fact could easily be understood. Besides this, the arc was enclosed by a steel container which acted as a shield.

Replying to Mr. Desbaillets' question in regard to power-factor correction by means of a rectifier set, he admitted that in this respect a rectifier had some drawbacks. However, the correction possible by means of a synchronous converter was also very small, and it might therefore be said that compared to a motor-generator set both the mercury-arc rectifier and the synchronous converter must be considered to be practically of equal value for power-factor correction. The cases where power-factor correction is a main item in a converting station were very few, and were becoming more and more scarce as static condensers, or large synchronous condensers, were being used increasingly.

Mr. Kaelin's question relating to comparative prices of synchronous converters and mercury-arc rectifiers could probably best be answered by Mr. DeMulinen, to whom he therefore referred this enquiry.

Mr. E. DeMulinen.

Mr. DeMulinen drew attention to the author's statement that the rectifier functioned as a current valve independently of the voltage of the system, and stated that the insulation of the current-carrying parts of steel-enclosed mercury-arc rectifiers was practically the same from 200 to 5,000 volts, this being required to give the insulation the necessary mechanical strength. There was therefore practically no difference between a 250-volt and a 3,000-volt rectifier for a given current, except that the transformer had to be larger to take care of the increased output. The first cost per kilowatt of a rectifier, including all accessories, from the alternating current to the direct current side as compared to a rotary was higher at 250 volts direct current, about equal at 600 volts, and considerably lower at 1,500 volts. At 3,000 volts the price of a rectifier equipment was only about 40 per cent of the cost of a motor generator.

Comparative price data, however, would not be complete without a comparison of the erection, operating and maintenance costs. The author had calculated that the weight of a rectifier equipment was only about 60 per cent of the weight of a rotary equipment of the same capacity, including the necessary transformers. Furthermore, the rectifier did not need special foundations, since it had no rotating parts. The costs of building and erection were considerably less for a rectifier substation than for a rotary converter substation.

The over-all efficiency curve of a rectifier, being a practically flat curve from light loads to overloads, brought about a considerable saving in the power bill in all systems with fluctuating load. The over-all efficiency of a 3,000-volt rectifier at full load was 97 per cent, and at 25 per cent load 95 per cent. The corresponding figures for a motor generator were 90.5 and 80 per cent. The mean efficiency of the rectifier would be 96.3 per cent, or about 12 per cent higher than the motor generator, when considering a load factor of 50 per cent and load fluctuations of from 25 to 200 per cent. In other words, the rectifier would effect a saving of 150 kw. hrs. per hour, or 1,300,000 kw. hrs. per year.

Electric Arc Welding

Recent Progress in the Application of Electric Arc Welding

R. E. Smythies, M.E.I.C.
Vice-President, Lincoln Electric Company of Canada, Limited.

Paper read before the Toronto Branch of The Engineering Institute of Canada, January 13th, 1927

Arc welding is destined to play an important part in the metal-working industries. It is probably true, however, that the importance of the change which is coming is not yet appreciated except by men who are actively engaged in the development of the process. These men know that before long there will be basic changes in this great industry, resulting from the use of arc welding. As a result of these changes, the established methods and traditions of metal working will be cast aside and sweeping changes in designs and processes will take place in every plant in which iron and steel is used as raw material.

Few engineers have hitherto given much thought to the idea of substituting welded steel parts for iron castings, and yet it is probable that progress in this field will be relatively much more rapid than in others. The economic arguments in favour of this change are so powerful as to be compelling, and there are fewer serious obstacles to be overcome than there are, for instance, in the field of structural steel engineering.

The almost universal reaction to this idea, when first confronted by it, is the thought that steel is less rigid than cast iron and that this necessarily limits the application very materially. The greater rigidity of cast iron is a fallacy, probably arising out of the fact that steel will stretch without breaking whereas cast iron, practically speaking, will not.

The fact is that if a steel beam carrying a given load and bending or sagging a certain amount were replaced by a cast iron beam of the same dimensions, the sag of the cast iron beam would be just two and one-half times as great as that of the steel beam, provided it did not break because of its lesser strength. Therefore, if a cast iron member subject to bending be replaced by an equal section of steel, the sag or bending would be reduced 60 per cent and the cost from 50 to 70 per cent, owing to the lower cost per pound of steel.

Actually, however, the cost would be reduced much more than this because the designer would naturally take advantage of the superior strength and stiffness of steel to reduce the section and also by using a section of a size and shape calculated to resist the stresses to the greatest advantage. Any shape which can be readily cast in iron is frequently not of the best design to resist bending stresses. Taking full advantage of all the possibilities, a saving in cost of as much as 80 per cent would be effected. This may seem like the wild statement of a visionary, but it is a statement the truth of which may be proved easily by anyone sufficiently interested to take the trouble to investigate.

The saving to be effected by substituting steel for cast iron parts in compression is not quite as great, although still considerable. The ultimate strength of cast iron in compression is greater than steel, but cast iron requires a much higher factor of safety so that the permissible working stresses for the two metals are approximately the same. The saving to be effected, therefore, is the amount of the difference in the cost per pound.

The superior strength of steel in tension is too well known to permit of discussion, and it follows that the arguments in favour of the use of steel for parts subject to bending apply with even greater force, and that there would be more striking reductions in cost.

The perfection of the arc welding process has made it possible to take advantage of the superior qualities of steel. It is another fairly widespread fallacy that arc welding is an expensive process. It is, in fact, by far the most economical process in use to-day for joining two pieces of steel together. The use of the process along the lines described

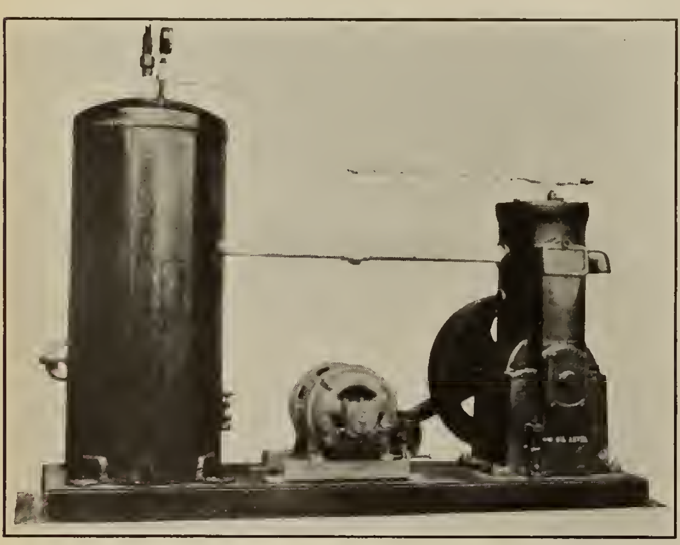

Figure No. 1—Motor with Welded Steel Frame Driving Compressor Mounted on Welded Steel Base, with Welded Steel Receiver; Illustrating Trend in Machine Design towards this type of Construction.

Figure No. 2—Method of Fastening Shelf Support for Brick Walls to Spandrel Beam.

Figure No. 3—Method of Welding Flanges and Window Supports to Floor Beam.

above has developed far enough to demonstrate that the actual cost of such welding, when efficiently done, should fall somewhere between one cent and half a cent per pound of the weight of material in the parts welded.

When considering the direct savings which can be made in production costs by this means, it should not be forgotten that in many cases the indirect savings are almost as striking. The work of designing and draughting is very much simplified and the cost of patterns is entirely eliminated. It is not necessary to carry large stocks of castings on hand over a period of time long enough to allow them to " season."

In one case, a machinery manufacturer's inventory was actually reduced from $750,000 to $60.000 by the substitution of welded steel for cast iron in his product.

The reduced cost of making changes in design and the elimination of stocks of obsolete parts are other obvious advantages. In many cases it is possible to cut down the amount of machine work necessary, and actual experience has shown that the amount of floor space required for a given output is also materially reduced.

Cast iron has been used so extensively because of the relative ease with which it may be cast into a predetermined shape. For this reason, engineers have overlooked its fundamental unsuitability for many of the purposes for which it is used.

Now that the arc welder has made it possible to economically fabricate standard steel shapes into any desired form, the last reason for the continued use of cast iron for many purposes has disappeared. This does not necessarily mean that many of the iron foundries will go out of business. There is no reason why the iron founder should not adopt the new process and turn it to the advantage of his customers and therefore benefit his own business. In fact, this would seem to be the logical thing to do. Industrial history proves that the greatest successes have been achieved by men who were quick to see new developments coming and had the vision to apply such developments to their own products.

There are also plenty of examples in history to prove that those who are most affected by great changes are usually the last to see them coming. The builders of wooden ships scoffed at the first iron vessel and the buggy-maker laughed at the first automobile, but neither the wooden shipyard nor the buggy factory ranks among the leading industries to-day.

Arc Welding vs. Riveting

It is safe to say that arc welding may be substituted for riveting in every case at an appreciable saving in cost. The new process has already made great strides in the manufacture of steel storage tanks and in other lines in which there are not any artificial obstacles in the form of official codes of rules and regulations governing methods of fabrication. Where such codes exist, as in connection with pressure vessels and steel buildings, for instance, progress is necessarily slower.

One does not need unusual vision, however, to foresee the gradual elimination of the rivet, from even the most jealously guarded fields, by means of the economic pressure exerted by the new process. The savings to be effected by the substitution of arc welding for riveting are many, and are both direct and indirect. Riveting is a complicated, costly and clumsy process. Every joint in a riveted structure must be carefully figured out in detail in the draughting room and every rivet hole carefully located in the shop and matched up with the holes in the various pieces which are to be joined together. Every member of the structure is

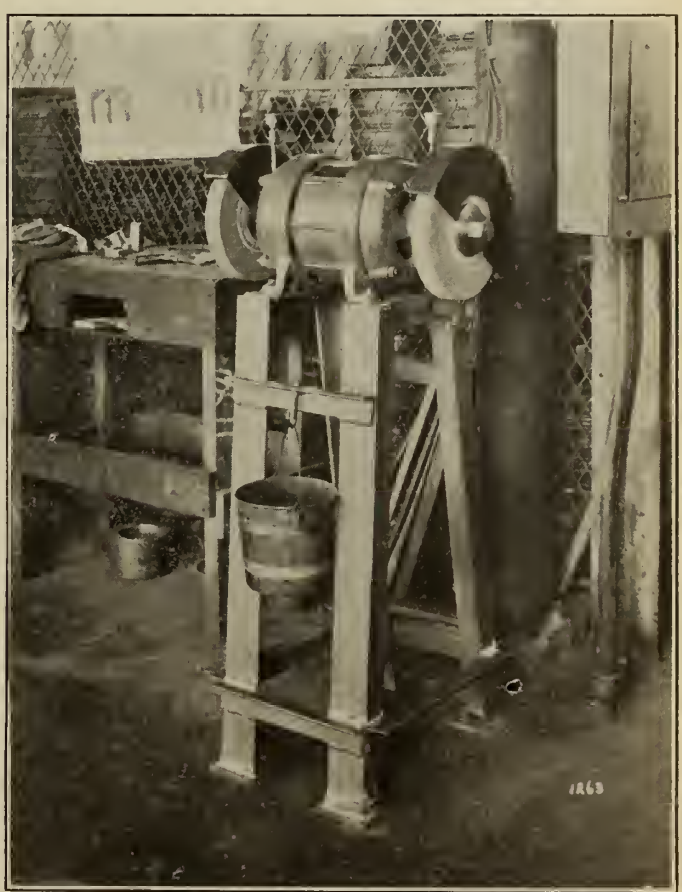

Figure No. 4—Steel Stand for Motor-Driven Grinder. Lighter, Stronger and Cheaper Than Cast Iron.

Figure No. 5—Special Automatic Spot-Welder; Frame Made of Welded Steel.

weakened by the amount of metal removed in making rivet holes.

Welding adds metal instead of removing it. Therefore, it is quite practicable to make a welded joint which is considerably stronger than the pieces joined, or, in other words, a joint having well over 100 per cent efficiency. A slight study of the theory of welded joint design makes this obvious, and it has been proved many times by practical tests.

Possibly the largest welding contract hitherto undertaken is the fabrication of the 90-mile steel pipe line for supplying water to the city of Oakland, California. This contract was let for arc welded pipe at a saving of some $3,000,000, or 40 per cent, as compared with riveted pipe. This saving may be considered as typical rather than exceptional and may be duplicated or even exceeded on most work involving the joining together of pieces of steel hitherto accomplished by the process of riveting.

Some progress has been made in the erection of structural steel buildings by arc welding and entirely without the use of rivets. One of the most striking examples was the erection of a large gas-holder with all the usual auxiliary steel work in Melbourne, Australia. The engineers responsible for this work investigated the matter of joint design very thoroughly and compiled a great amount of valuable data on the subject which is available to anyone interested. The Bureau of Standards at Washington has made some fairly extensive tests of welded structural steel members, and many of the universities have done likewise. It is no longer true, therefore, that there is no unbiased and authoritative information available as to welded joint design and the relative strength of welded and riveted joints.

One objection often raised to the use of welding is that it is impossible to determine the strength of a welded structure without destroying it. There is some truth in this, but surely it is also true of structures put together by any other process. The ultimate strength of any building is not really known until an earthquake or a hurricane of exceptional violence comes along and proves that they were not strong enough. It is certainly possible by the scientific use of arc welding to develop the full strength of the steel in any structure and so make the completed building considerably stronger than by any system of riveting that could be devised, at the same time effecting considerable savings in cost.

Many engineers seem to feel that the process of welding has a harmful effect on the physical structure of the steel. There is possibly some foundation for this belief. Here again it depends on whether the welding is done in a scientific way or by haphazard, rule-of-thumb methods. There is plenty of evidence to show that it is quite commercially practicable to make welded joints which, when tested to destruction, will not fail either in or anywhere near the weld.

In the case of the Governor's bridge in Toronto, the specifications called for joints to be made 25 per cent stronger than the steel bars which were joined. This was done without any great difficulty and, although the entire design of this structure hinged on the use of arc welded steel, the total cost of the welding was only about 1½ per cent of the value of the contract. The steel consisted of 2½-inch diameter round bars of special steel having an ultimate tensile strength of 92,000 pounds per square inch and the joints were certainly more difficult and costly to make than would be the case with standard structural steel members.

Arc Welding in the Tool Room

Of the many fields of usefulness open to the arc welder, there are few in which the striking economies to be achieved by the process can be more readily demonstrated than in the tool room. The tool room in the average modern manufacturing plant is generally accepted by the cost department, with more or less resignation, as being something of a paradox, and a paradox which it cannot control, much as it would like to do so.

The tool room produces the jigs, dies and fixtures of various kinds which enable the rest of the plant to function efficiently and cut manufacturing costs down to a small fraction of what they would otherwise be. The tool room itself, however, is the one place in which costs cannot be controlled. Here the most highly skilled mechanics have practically a free hand as to the methods which they use and the time taken to produce a given article. These mechanics are very often men who received their training in European countries, and are really something more than

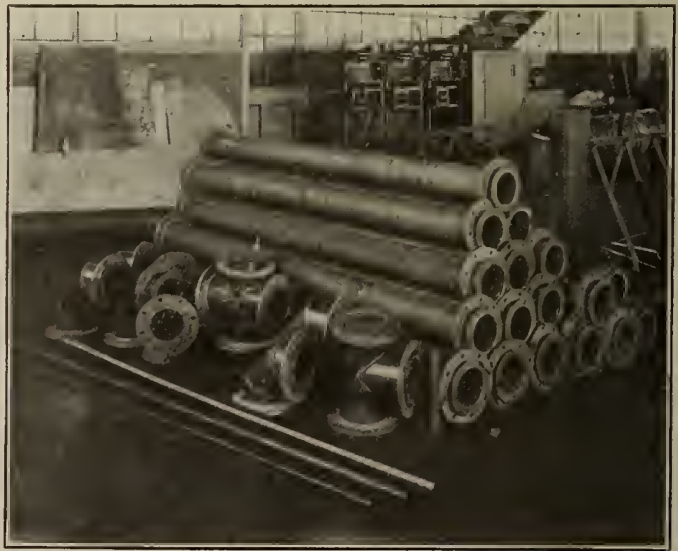

Figure No. 6—Arc Welded Pipe and Fittings Made of Stainless Steel. This is 6-inch Pipe with a Chromium Content of 28 Per Cent. This High Chromium Alloy Can Be Welded Very Successfully.

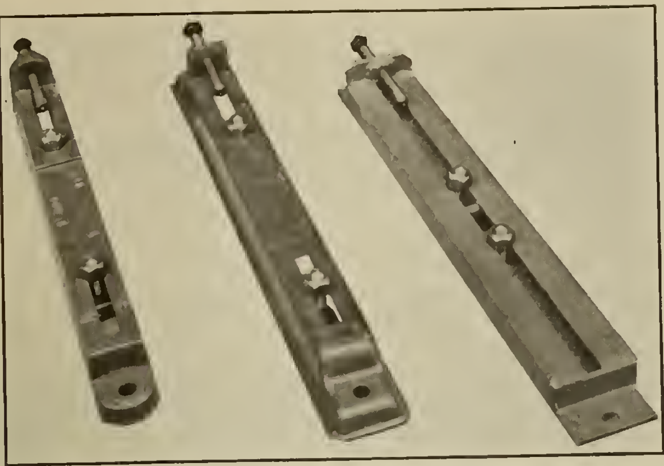

Figure No. 7—Motor Base Rails.

Cast Iron		Pressed Steel		Structural Steel	
Material...	$1.07	Material...	$ .66	Material...	$ .44
Labour....	.05	Labour....	.08	Labour....	.29
Total....	$1.12	Total....	$ .74	Total....	$ .73

mechanics. They are intelligent and highly skilled craftsmen who make fine tools because they like to make fine tools. Unfortunately, they often insist on making fine tools for operations which could be performed just as well with tools which could be made at one-tenth the cost.

In many plants the tool room cost is a very heavy item indeed. Any slight change made in one operation on the product may mean changing tools and fixtures all along the line. It may mean complete new fixtures for some preceding or subsequent operation. This causes delay in getting into production and entails large outlays of cash for skilled labour and supervision in making the changes. If production must be continued during the change, while the tool room is doing its job according to European standards of thirty years ago, the cost of the product usually mounts rapidly and may for a time exceed the selling price.

In a typical factory, it was calculated from carefully compiled data that the time required for making such changes in the product was cut by 90 per cent by the use of arc welding in the tool room. The conditions in this plant were easy as compared with a plant in which an entirely new product is to be turned out. Quite apart from the general saving of time in the producing departments of this plant, as distinct from the tool room, a careful comparison of a representative set of welded fixtures with a similar set made according to the old methods showed the cost of the former to be $175 as against $2,800 for the latter.

The fixtures used in the plant of a well-known manufacturer of washing machines for the purpose of holding the frames while spot-welding were made at a cost of $35 each as against an estimate of $625 each for making the same fixtures by the old methods.

Fixtures used in the manufacture of a welded steel joist were made at a cost of $130 each as against $1,250 each for similar fixtures previously made.

Instances of this kind could be quoted in great number, but perhaps the most striking is the case which occurred in the plant of a large and well-known factory producing telephone apparatus. Fixtures were to be made for use in the welding of machine switching frames. A complete set of fixtures was turned out by the foreman welder at a cost of $85. These were, however, regarded as temporary fixtures, and the tool design department and the tool room undertook to furnish permanent fixtures by the usual methods. These permanent fixtures when finished cost $15,000, but were never quite as satisfactory in operation as the welded fixtures which had cost only $85.

So far, however, it is only in a very few plants that electric welding has penetrated to the tool room. The highly skilled tool-maker still thinks in terms of riveting or bolting for joining two pieces of metal together, or, what is considerably worse, he thinks of cutting a tool or fixture out of a solid block of metal, whereas arc welding offers a cheap and ready means of putting various pieces of metal together to accomplish exactly the same result.

In many cases dies which have become worn in service may be saved from the scrap heap by having the worn surfaces built up by the arc welder. By judicious selection of a suitable welding rod it is possible to deposit metal of almost any desired degree of hardness, and a welded die may be subject to the usual heat treatment afterwards with good results.

There are, of course, limitations to the use of the process in this field. It is a fundamental characteristic of the metal deposited by the arc welder that it is a cast metal and does not have the property of ductility to the same degree as the forged material from which many die blocks are originally made.

It is now generally recognized by manufacturers that in an era of falling prices and shrinking dollar volume of sales an industrial enterprise, to survive, must reduce costs by the use of more efficient methods. The introduction of arc welding into the tool room offers the opportunity to very materially reduce expenses in an important department which is generally regarded as enjoying a special immunity in the matter of costs.

Incidentally, it has been found that it tends to eliminate a great deal of lost motion, friction and circumlocution between the various departments of a factory. The engineering department usually designs jigs, fixtures, dies and such special equipment as cannot be purchased in the open market. When the drawings are made the engineering department turns the job over to the tool room to make, and that is frequently the signal for the commencement of a three-cornered wrangle between these two departments and the production department which has to use the jigs when made. Much time is lost in this way, and if the jigs or fixtures do not work satisfactorily when made each department blames the other for the trouble.

		¼" Bead		5/16 Bead		⅜" Bead		½" Bead		⅝" Bead.	
Size of Rivet inches	Shearing Value of Rivet at 10000 lbs */□"	Shearing Value per inch of Bead lbs	Length of Bead. Inches.	Shearing Value per inch of Bead lbs	Length of Bead Inches	Shearing Value per inch of Bead lbs	Length of Bead Inches	Shearing Value per inch of Bead lbs	Length of Bead Inches	Shearing Value per inch of Bead lbs	Length of Bead Inches
½	1960	1600	1¾	2000	1½	2400	1⅜	3200	1⅛	4100	1
⅝	3070	1600	2½	2000	2	2400	1¾	3200	1½	4100	1¼
¾	4420	1600	3¼	2000	2¾	2400	2⅜	3200	1⅞	4100	1½
⅞	6010	1600	4¼	2000	3½	2400	3	3200	2¾	4100	2
1	7850	1600	5½	2000	4½	2400	3¾	3200	3	4100	2½

Table No. 1—Shearing Values for Welds and Equivalent Size of Rivets.

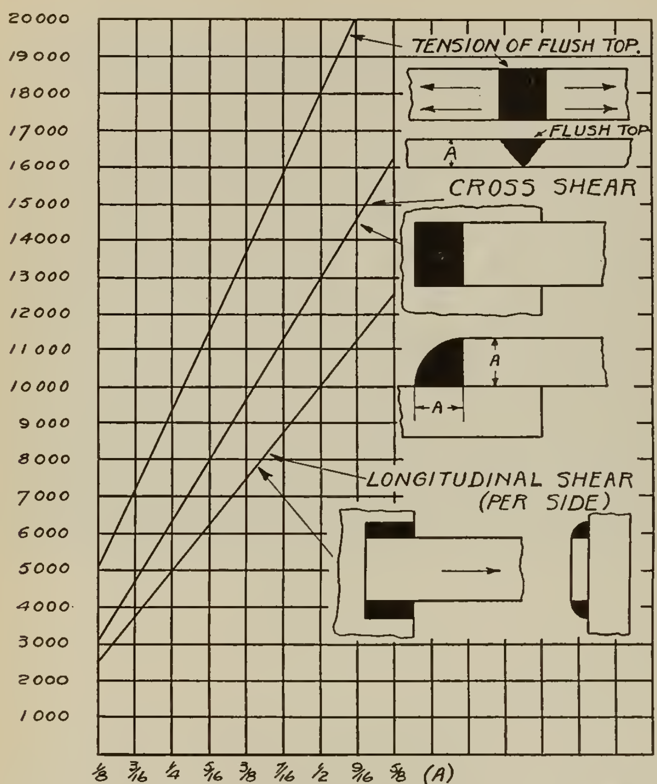

Figure No. 8—Rupturing Force Per Linear Inch of Weld.

In many cases a fixture could be made by welding, to a rough sketch at a trifling cost, and then, if necessary, an improved design worked out from the fixture in actual use.

Arc welder equipment costs little enough, as compared with its wonderful field of usefulness and with the cost of ordinary machine tools, such as lathes, drills, milling machines and planers which are usually purchased readily enough when the tool room requires them.

The arc welder is not a difficult tool to use. Any mechanic as intelligent and skilled as a tool-maker can learn how to operate it quite satisfactorily in a very short time. Some tool-makers are naturally conservative in their ideas and inclined to be prejudiced against innovations of this kind. Generally speaking, however, they will see that their prosperity is bound up with that of their employers and that in times such as the present keen competition makes it imperative to take advantage of such economies as the arc welder offers.

At the present time some well-known firms are using the arc welder extensively in their tool rooms, and the results they are getting would seem to make it certain that the practice will spread rapidly.

Arc Welding of Alloy Steels

Interesting developments are looked for in the near future in the direction of the more extended use of rust-resisting or " stainless " steels and other special alloys which are developed for particular purposes.

It has been demonstrated that the high chromium alloy which is now being turned out in large quantities by several mills can be welded by the electric arc process very successfully indeed. On account of the relatively high cost of this alloy, it is of the utmost importance that full advantage should be taken of the cheapest possible method of fabrication.

The welding of high, (14 per cent), manganese steel has also been carried out with entire success and great economies in connection with such applications as the building up of crusher jaws, switch points and cross-overs in railway tracks and other parts manufactured from this extremely hard and expensive metal.

There is ample evidence to prove that it is quite practicable to obtain a deposit or weld metal of almost any desired analysis and characteristics. At the same time, it is obvious that arc welding is in its infancy and that there is a vast and interesting field for research open to electrical and mechanical engineers, metallurgists and others.

Need for Official Recognition

There is undoubtedly a great need for official recognition and acceptance of the welding process by engineering societies and public authorities generally. There is need for a code of rules and regulations on welding similar to the codes which have long been in existence for riveting.

The economic reasons for the increased use of the arc welding process are so strong that progress is sure to be rapid, although it may be delayed by tardy official recognition of the process.

Oil Paints and Their Application

Some Practical Notes on Materials Used and Methods to be Adopted to Obtain the Best Results under Various Conditions

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In the following paper the writer has endeavoured to treat the subject from an entirely practical point of view, and has therefore omitted considerable technical discussion and given a brief explanation of the materials used for oil paints and the methods to be adopted to obtain the best results from the application of these paints under various conditions.

A good oil or varnish paint should have a high degree of opacity or hiding power, that is, it should not take more than three coats to obliterate the darkest background upon which it may be applied; its pigment should be ground to a very fine state, the more nearly colloidal the better, in order to obtain higher opacity, a smoother film, greater covering capacity, greater impermeability of the film to moisture, and longer life owing to greater protection of the oil film to decay from the effects of the weather or actinic rays. A good paint should not cake or settle to a hard mass in the container, which is another reason for greater fineness; it should brush and spread well, giving a smooth film free from brush marks, but should not be so thin that it will run or sag; it should dry in a reasonable time—oil paints should be dry to touch in from eight to ten hours at 70°F., varnish paints should be dry to touch in from four to six hours and hard dry in twenty-four hours at the same temperature; and it should form, on drying, a film that will resist as long as possible the conditions to which it is to be exposed. No paint, however well made or however high grade its constituents, will serve all purposes. A paint that will stand well under dry conditions would be useless under moisture, and a paint designed for interior purposes would fail utterly when applied on an exterior surface; a paint intended for mural decoration would not last any time if used on a floor. Thus, paints have to be designed and applied with a view to their ultimate purpose, and it is hoped that consideration of what follows may help to shed a little knowledge on this subject.

Pigments

Paint is a suspension of a pigment, or pigments, in a vehicle. The use of pigments is necessary to furnish colour and opacity for obscuring the background, to promote hardness, impermeability and weather-resistance in the film, and, by the formation of a two-phase solid-liquid system, to allow the application of thicker films than would be possible with an unpigmented vehicle.

Pigments may be divided into two classes, (1) basic or tinting pigments and (2) fillers and extenders. There is no hard and fast division between the basic and tinting pigments, as some may be used for both purposes. The important pigments used in paints are the following:—

White— White lead, zinc oxide, lithopone, antimony oxide and titanox.
Yellow—Chrome yellows and ochres.
Red— Red lead, iron oxides, (indian, venetian and turkey reds), and lakes.
Brown—Siennas, umbers and iron oxide.
Blue— Prussian, ultramarine and cobalt blues and lakes.
Green— Chrome greens and chromium oxide.
Black— Black oxide of iron, graphite and the various lamp, drop, ivory or bone and carbon blacks.

The fillers and extenders chiefly used in paint making are barytes (barium sulphate), asbestine, silica, china clay and whiting.

Of the white pigments, lithopone is the only one not used to any extent for exterior work. It may be used, however, providing it is ground with a strong vehicle, such as a good exterior or spar varnish, or else in combination with about 50 per cent zinc oxide. The same holds true, though perhaps to not such a great extent, in the case of antimony oxide and titanox. The white pigments most commonly used for outside work at the present time are white lead and zinc oxide, usually a mixture of the two in the proportions of about 70 per cent of the former to 30 per cent of the latter. Antimony oxide and titanox are newer pigments, but are being quite extensively used and are giving very good results. The so-called active pigments, white lead and zinc oxide, give tougher and longer-wearing films than the other white pigments due to their chemical reaction with the oil. As stated above, white lead and zinc oxide should be used in combination for all ordinary exterior purposes. In places, however, where the film is liable to come in contact with sulphur or sulphides, white lead should not be used owing to its tendency to turn black, (formation of lead sulphide). In such a case it would be better to use one of the newer pigments, antimony oxide or titanox, together with about 30 per cent zinc oxide. In damp places, or under water, the amount of zinc oxide with the white lead may be varied from 50 per cent upward, or zinc oxide alone may be used, depending on the conditions, as the hard film formed by this pigment resists the action of moisture well. It may be noted here that from the results of recent experiments it has been shown that zinc oxide is the most resistant of all white pigments to actinic or ultra-violet rays. These rays are one of the greatest causes of deterioration of paint films on exterior exposures, and therefore the inclusion of from 10 to 30 per cent of zinc oxide in all white or light coloured paints intended for exterior use is claimed to extend the life of a paint film to a large degree.

Most of the coloured pigments are used for tinting the white pigments to the different shades of greys, greens, buffs, creams, etc., which are used for body colours for exterior and interior painting. It is a well-established fact that tinted paints resist weathering and the actinic rays for a much longer time than white, and in this respect the darker colours or shades usually wear better than the lighter ones. However, the choice of colour is purely a case of individual taste, which as a general rule runs to the lighter shades, they being brighter and more cheerful.

Besides being used as tinters, many of the colours, such as the ochres, chrome greens, some of the iron oxides, and blacks, etc., are used alone as trim colours on the body colours mentioned above. Certain other colours, such as chrome yellows, red lakes, blues, etc., owing to their brightness, are used extensively for signals or signs, or special purposes for attracting attention.

Of the coloured pigments, red lead, iron oxide and graphite find extended use in the protection of metals, red lead being the best for this purpose, and the other two about equal. Present practice is to use 15 to 20 per cent of zinc oxide with iron oxide to give a harder and better wearing film. This is due to the active zinc oxide uniting with the oil and to its resistance to actinic rays, as already mentioned. Red lead is one of the active pigments, and the strength which it imparts to the paint film is due to its union with the oil. Red lead for paint purposes should contain at least 96 per cent Pb_3O_4, true red lead, the remainder being PbO, litharge, and should be ground extremely fine. The ordinary so-called painters' red lead contains about 15 to 20 per cent litharge and is fairly coarse. This litharge and the coarse particles are the cause of the serious objections made in the past to red lead paint. The litharge caused the paint to become viscid and ropy, and thus hard to apply, and if allowed to stand for any length of time made a hard, compact, heavy, cement-like solid in the bottom of the container. The coarse particles in it caused runs and uneven lumps and streaks, spoiling the appearance and wearing qualities. With the appearance of the present-day high grade red lead, which runs as high as 98 per cent true red lead, all the objections against red lead are done away with and first-class results are obtained.

Extenders and fillers have little or no colouring capacity, and for this reason find a useful place where consistency is desired without changing the colour. Of these materials, barytes, asbestine and china clay find their greatest use in reducing many of the coloured pigments which in themselves are too powerful to be used alone in paints. Whiting is mostly used in making putty and cold-water paints, but is not a good extender for oil paints owing to its poor wearing qualities. Silica, due to its hardness, is considered an ideal extender, but owing to the difficulty of grinding it to a sufficient fineness, and the heavy abrasive wear it causes in the paint mills, is not used as much as it might be. It finds its greatest use in wood fillers and in some classes of paint where "tooth" is required.

Vehicles

The vehicle is the most important part of a paint, and may be of three parts,—(1) the oil or varnish which binds the pigment particles together and the film to the surface upon which it is applied, (2) the volatile thinner which gives the paint the necessary working qualities, and (3) a liquid or japan drier which may be added to hasten the drying process, especially where an oil, such as raw linseed oil, containing no drier is used.

For all ordinary purposes, raw and boiled linseed oils and china wood oil are those chiefly used. In certain cases where the surface to be painted is to be subjected to considerable wear it is advisable to use good long-oil exterior, or spar varnish in the vehicle. The use of all these various oils and varnishes will be discussed under the section on "Paint Coatings." The use of other drying oils, such as perilla, fish or soya bean, should not be attempted by the painter unless he is an expert, as they require very careful manipulation. As a rule, they are only used by manufacturers of paint for special purposes.

The volatile portion of the vehicle may be pure gum turpentine, wood turpentine or one of the turpentine substitutes, such as mineral spirits or coal-tar naphtha. Present practice has shown that the substitutes produce just as good results as pure gum turpentine, and they are much cheaper. In the section on paint coatings, where volatile thinners are mentioned, any of the above may be used.

Liquid or japan driers should be used with great caution, as an otherwise good paint may be ruined by their improper use. They should not be used by anyone who does not thoroughly understand their action. Boiled linseed or china wood oils and the long-oil or spar varnishes all contain sufficient driers to cause them to dry within a reasonable time. If raw linseed oil is used only as indicated under "Paint Coatings," no drier need be added to it.

Preparation of Surfaces for Painting

Woodwork

All surfaces to which paint is to be applied must be thoroughly clean, dry and free from grease. Many woods, such as yellow pine, spruce and cypress, contain resins that tend to destroy any paint put upon them. Exposure of exterior woodwork to the weather for about six months prior to painting would bring these resins to the surface, where they would be either washed away or hardened, leaving the wood in a much better condition for painting. However, it is not always advisable to leave wood thus exposed for any length of time, as temperature changes, alternate rain and sunshine, etc., are liable to cause cracks or otherwise injure the wood.

As an alternative for this treatment, several other methods for both exterior and interior woodwork are resorted to by painters. The vehicle of the priming coat may be made up of equal parts linseed oil and turpentine, or benzol, (coal-tar naphtha), may replace 30 to 40 per cent of the turpentine. This vehicle is claimed to dissolve the surface layers of resin and allow the paint pigments to penetrate into the fibres of the wood and prevent the resins being forced to the surface. Knots and very sappy woods are often treated by the application of one or more coats of shellac varnish or with a brush coat of turpentine not more than one hour before the application of the priming coat.

Another good method, although entailing more work and expense, is to use a mixture of equal parts by weight of white lead in oil and pure dry red lead. The latter is mixed in a vehicle of two parts of raw linseed oil and one part of turpentine, the white lead is incorporated, and then the mixture thinned with more of the vehicle to a thin consistency and applied as a priming coat, which should be well brushed in. All these treatments are likely to fail, however, in the case of improperly seasoned wood, especially on a southern exposure. A method which has met with a great deal of success under all conditions is to coat all knots, or sappy, or resinous parts of the wood with one or more coats of aluminum bronze paint previous to the application of the priming coat.

In the case of woodwork which has previously been painted, the condition of the old paint must be taken into consideration. If it adheres firmly to the wood it may be regarded as a priming coat after first removing, by washing, brushing, scraping or sandpapering, all dust, soot or loose scales. For surfaces that require washing it is better not to use soap unless it is thoroughly rinsed off, as soap will leave a greasy film detrimental to the adhesion of the paint to the surface. Washing soda or tri-sodium phosphate are recommended instead of soap, and even with these several rinses are most advisable, including at least one wash with weak vinegar.

If the old paint is loose or badly checked or cracked, it is better to remove it. This may be done most efficiently by burning it off with a torch, which causes the paint film to soften so that it may be readily scraped off. Great care must be used to prevent excessive scorching of the wood, which is difficult to prevent on other than flat surfaces. Where the torch is not applicable, one of the following solutions may be applied hot with a fibre, (not bristle), brush, or swab, until the paint softens sufficiently to be removed with a scraper or wire brush:—

(*a*) One pound caustic soda to two gallons water
or (*b*) One pound tri-sodium phosphate to two gallons of water
or (*c*) Two pounds ordinary laundry soap, one quart ammonia and one pound saltpetre in two gallons water.

These solutions should be used with great care, as they are very injurious to the skin and clothing. If the alkalies are left in the wood they will damage the paint film when it is applied, and for this reason these treatments should be followed by a thorough washing with water, then one of strong vinegar and then two more of clean water. After the wood is thoroughly dry it must be well sandpapered, as these treatments raise the grain of the wood, thus making the surface rough.

A number of paint removers on the market consist of mixtures of benzol, acetone and methyl alcohol in which are often dissolved certain waxes to retard the evaporation of the solvents. Any waxy residue left from the use of these types of paint removers must be thoroughly cleaned off the work by washing with gasoline. These removers, while doing their work well, are costly, due to the high price of their ingredients and the large quantity required owing to rapid evaporation. Care should be taken in their use owing to the toxic effects of benzol and methyl alcohol.

Plaster, Cement and Brick

Old surfaces must be thoroughly washed with washing soda and water to which a little ammonia may be added in order to remove soot, grease and other dirt which collects on them. If the surfaces have been previously whitewashed or calcimined it is absolutely necessary to wash this all off before preparing the surface for painting.

All cracks should be wetted and filled with cement mortar or plaster of paris. Plaster of paris filling is liable to be more porous than the surrounding wall, and therefore should be given one or two preliminary applications of the same paint that is to be used on the whole surface. In the case of brick surfaces, all loose plaster and crumbling brick must be removed by thorough washing and scraping and any mould cleaned off with a solution of equal parts muriatic acid and water.

After the surface is thoroughly clean it must be neutralized by treating it with a solution of aluminum sulphate or zinc sulphate, which not only neutralizes any alkali but also helps to fill the pores with the products of the reaction that takes place. The sulphate solutions are made by dissolving two pounds of either of these commercial salts in one gallon of water. Glue size should never be used to fill the pores of the surfaces previous to painting, as is often done, as it has a tendency to take up moisture to the detriment of the paint film. To fill the pores in plaster or cement use ordinary paint, or the paint intended to finish the job, thinned with linseed oil to about half its original consistency. In the case of brick surfaces, it is customary to apply a preliminary treatment of boiled linseed oil thinned with turpentine. No paint of any kind should be applied to surfaces of this type until they are absolutely dry, as any moisture remaining in the wall or floor will eventually come out, causing the paint film to blister.

Metals

All metals, especially if the surface is smooth and polished, present difficulties in painting, as the film is liable to peel off, due to the lack of firm anchorage or to the presence of a very thin film of grease. The latter may be removed by thoroughly cleaning with benzol or gasoline. The best method for removing rust or dirt is by sand-blasting. Tests carried out in the United States have conclusively shown that paint applied to metal surfaces which had been cleaned in this manner adhered much more firmly to the metal and thus had longer life. However, it is not always possible to use the sand-blast, owing to the special equipment required; or economical from the standpoint of the size of the job. In such cases rust or dirt must be removed down to the base metal by means of scrapers, wire brushes or sand paper. Sandpapering any smooth metal surface increases the anchorage for the paint to a great extent, and should always be done. Of special interest here might be noted the invariable tendency of steel structures to rust at the rivets and edges of the members. In fact, the rusting in the former case often reaches such serious proportions that it develops sufficient expansive force to rupture the connecting rivets, which have to be renewed from time to time, especially in the case of bridges. The cause of this rusting is claimed to be due to shrinkage of the paint film with subsequent cracking at these points. As a means of perhaps preventing this tendency, to some extent at least, all rivets and angles should be given an extra coat of paint following the priming coat and previous to any other coats. Frequent inspection, and thorough cleaning and painting before such rust progresses to a marked degree, is recommended as a further preventive.

Galvanized iron and zinc are particularly difficult to paint on, but may be made to hold paint if first treated with a solution of four ounces of copper sulphate or eight ounces of ammonium chloride, (sal ammoniac), to a gallon of water. The copper sulphate solution should be made in a stoneware vessel, and should be applied in a thin coat to the metal surface and allowed to dry overnight. The ammonium chloride solution may be mixed in any type of container and after application should be washed off with clean water.

Paint Coatings

Priming Coats

The purpose of the priming coat is to fill the pores of the surface being painted, and to furnish a foundation on which the subsequent coats may be applied. For this reason it should be composed of good materials and applied with great care, being brushed in thoroughly so that it is evenly distributed with no tendency to run. Many paint failures may be traced directly to faulty priming, especially those where considerable peeling occurs. The composition of the priming coat, as a rule, should be the same as the succeeding coats, except that it contains considerably less pigment. It should be made thin, and the replacement of some of the oil by a volatile thinner makes a flat and harder surface.

The reason for using a thin paint of this type for priming becomes apparent when it is to be applied to a very absorbent surface like wood. Owing to the capillarity of the wood cells it is necessary to apply a coating which will penetrate the grain of the wood to form a "key" for the next coating, but which will not at the same time, when once dried, be so reduced in its oil medium or "binder" by that capillarity that it will powder off. This end is attained by pigmenting the paint more lightly in order to ensure more available medium, and at the same time reducing the viscosity and thereby increasing the penetrative power by diluting the oil medium with a volatile thinner.

A priming coat for woodwork may be made with twenty pounds of white lead oil-paste thinned with one gallon of equal parts boiled linseed oil and volatile thinner. A mixture of two parts white lead to one part red lead may be substituted for all white lead, and is used a great deal for exterior work.

For plaster walls the paint to be used for the finishing coat may be used as a primer after thinning to about half consistency with boiled linseed oil. The new flat wall paints may be used for priming as well as finishing, and when used for the former purpose should be thinned with about one quart boiled linseed oil to one gallon of the paint.

Concrete surfaces are best primed with a paint made in the proportions of ten pounds of white lead paste to one gallon of boiled linseed oil, unless previously treated with aluminum or zinc sulphates, when it would be permissible to prime with the finishing paint.

For brick, the priming may be done with boiled linseed oil, as mentioned before, and on this any desired paint may be used.

No better paint than high grade red lead is known for adhering to and protecting metal work. A priming coat for metal surfaces is made by mixing twenty-five to thirty pounds of pure, dry, high grade red lead in one gallon of boiled linseed oil and thinning with one-half pint of a volatile thinner.

All holes and cracks should be filled with putty after the priming coat is thoroughly dry and before any other coats are applied.

Intermediate Coats

All surfaces should have at least one intermediate coat between the priming and finishing coats, and, for best results, especially on new work, two or three are recommended. All intermediate coats should contain enough thinners to cause the paint to dry flat, in order to furnish a good foundation for the next coat. An intermediate coat may be of the same kind of paint as an oil finishing coat with part of the oil substituted with a volatile thinner. As the thinners have roughly twice the thinning power of oil, only half as much thinner should be added for the quantity of oil being replaced, otherwise a smaller amount of pigment per unit area of surface will result, thereby producing a weaker film. All coats should be well brushed and spread, and it must be borne in mind that a larger number of thin coats, well applied, will give far better results than a few thick coats slopped on in any fashion. Ample time should be allowed between coats for thorough drying, and paint should be applied under warm, dry conditions whenever possible. The colder and more moist the surroundings the longer the time required for drying. As an example, most paints are made to dry to touch in eight to ten hours at 70°F., but it has been proven that at 60°F. the same paint takes about twenty hours to dry, or double the time, or at a still lower temperature, especially if the humidity is high, the paint may take from two to three days or longer to dry.

Finishing Coats

The finishing coat is the one that has to stand wear and tear and weathering, as well as give a pleasing effect to the painted surface, and for this reason great care should be exercised in its choice and application.

In all cases, except perhaps for interior mural decorations, it should dry with a high gloss, as a high glossy surface is much more durable than one which has a dull finish. This may be accomplished by leaving out all, or nearly all, of the thinners, or by substituting a good long-oil exterior varnish for the thinners and about 10 per cent of the oil.

Ordinary finishing paints to be applied to exterior surfaces should contain little or no thinners, the vehicle consisting of equal parts raw and boiled linseed oil. For floors, both exterior and interior, a durable hard-drying varnish should replace the raw linseed oil. For finishing paints that will be immersed in water or subjected to excessive dampness the vehicle should consist of the best grade spar varnish only. For interior woodwork durability is perhaps not as essential as appearance, and paints may be chosen accordingly. For white or light tints to be used in interiors little or no linseed oil should be used, owing to its tendency to yellow; china wood oil may be substituted. A little china wood oil varnish may be added to interior paints to give a higher gloss. For high grade interior work, good quality enamels may be used in any desired tint.

Interior plastered walls may be finished either with the new flat, washable wall paints which are usually made with lithopone, china wood oil, a large percentage of petroleum spirit, and tinting colours, or they may be finished with the glossy paints mentioned for interior woodwork. Cement and brick walls may be finished in a similar manner to woodwork, having due regard for the exposure, etc.

For metal work, as already stated, no paint can be recommended more highly than red lead for all coats; the final coat being tinted brown, black or grey to suit the taste.

Mixing of Paints

Having briefly described the various important materials used in paints and the best ways of using them, it might be in order at this point to say a few words as to the methods of mixing these ingredients in order to produce paints.

In the first place, it is an utter impossibility to make thoroughly homogeneous mixtures of oil and dry pigment without the use of a special grinding mill such as used by paint manufacturers. For this reason this part of the operation should be left to them, and the desired combination of oil and pigments should either be purchased in the form of a mixed paint ready for application or the various pigments may be obtained in the form of pastes, which the purchaser may dilute and blend with oil and thinners to meet his needs as regard consistency, colour and use. This latter method is to be recommended, as by it a check may be made on the pigments, as well as the oil, varnish or thinners. Once a paint is mixed it is practically impossible for an analyst or anyone else to tell much regarding the vehicle portion, which is the really important part of the paint, but by buying the ingredients separately each one may be examined for quality.

Other advantages of buying paints in paste form show themselves in the economy of transportation, the possibility of storage without loss by evaporation, excessive formation of skins, or hard settling in the containers, and the fact that they may be thinned down to a working consistency with any medium to suit the conditions of application, and only sufficient need be mixed at any one time to meet immediate requirements. Except in the case of certain colours which are such complicated mixtures that they require special mixing, all the ordinary paints may be made by purchasing the necessary pigments in paste form, and, after breaking them up with oil, mixing them thoroughly to obtain the shade or colour required.

In mixing paints, all the paste ingredients should be broken up to a thick creamy consistency with oil, and then incorporated one at a time with the basic pigment by thorough stirring. When the paste colours are thoroughly blended, the necessary oils, varnish or thinners may be added in the order named, and in accordance with the requirements of the surface to which the paint is to be applied. A paint made up in this manner should be strained before use through muslin or a fine wire strainer, in order to remove any skins or lumps of paste that may not have been properly broken up and would have a tendency to cause streaks.

Different colours and shades may be produced by the blending of certain standard colours which may be readily purchased in paste form. The blending of these colours cannot be made by any hard and fast rule, as different samples of the same colour vary in strength and tone, so that the same quantity will not always produce the same results. However, the following illustrations are given as a rough guide to the shades usually met with:—

A white pigment and lampblack give a series of greys varying in depth of colour according to the proportions of black and white. If this grey is considered "cold," the addition of a little yellow ochre or sienna will make a much "warmer" shade. Burnt umber used in the place of the ochre or sienna will give a series of grey drabs.

A white pigment and yellow ochre give a series of buffs, and the addition of a touch of venetian red to a light buff gives cream. Ivory is best produced by the addition of a very little medium chrome yellow to white. Yellow drabs or drab stone colour may be produced with white, yellow ochre or chrome yellow, and burnt umber.

A series of browns may be produced by mixing, in varying proportions, indian or venetian red, lampblack and yellow ochre. Brown drabs will be obtained by the addition of white to the above.

Brick reds are produced with yellow ochre, venetian red and white, the colour depending on the proportions used.

Various blues are obtained by tinting white with either ultramarine or prussian blues.

Chrome greens are obtained in many shades, which may be further modified by the addition of white, black or some other colour. For instance, pea green is obtained by tinting white with medium chrome green, or apple green by adding a little chrome yellow to pea green. Lampblack and dark chrome green give bronze green, or a richer shade may be produced by adding ivory black and a little raw umber to medium chrome green.

Selection and Care of Brushes

A few words may not be out of place here with regard to the selection and care of brushes. Only the best brushes should be used in order to obtain the best results, and these brushes should be kept in good condition.

For large work, the so-called pound brush is recommended. This is a round brush, with bristles about six inches long when new. Owing to their length, such bristles would be too flexible and it is customary to "bridle" the brush by winding a strong cord for from 2 to 2½ inches on the base of the bristles. This may be removed as the bristles wear down. The object of the binding is to prevent the brush from being too soft and spreading like a mop, its purpose being to rub the paint into the surface and remove the air film and probably a thin film of moisture which adhere strongly to it, especially if it be metal. This is one reason why brushing is preferred to spraying. A new bristle terminates in a fork or feather, that is, it is split up a short distance, and it is this that holds the paint. A good brush should have such bristles of different lengths all through it, so that as it wears down it will still have this necessary quality.

Flat brushes up to 5 or 6 inches wide may also be used, especially for flat surfaces, though it is claimed that round brushes are more suitable for spreading the paint. Small oval brushes with a chisel-shaped end are most satisfactory for painting sashes and other small surfaces.

Brushes for oil paints should be well cleaned after use, though for overnight it is sufficient to wrap them in several thicknesses of newspaper or place them in a jar of water. To clean a brush, wash thoroughly in kerosene or gasoline, and, after shaking as dry as possible, wash with soap and water and finally with clean water. Shake out as much of the water as possible and hang the brush, with the bristles down, to dry. Brushes that have become hardened through not being cleaned after painting may sometimes be made fairly serviceable by immersing them in a mixture of benzol, wood alcohol and acetone, (proportions 5:4:1). After the bristles become loosened wash thoroughly with soap and water as before. If much painting is to be done, it is better to hang the brushes in a pail containing raw linseed oil. Do not allow the brushes to rest on their bristles on the bottom of the pail, but hang them from hooks attached to the side of the pail in such a manner that the bristles are just submerged. As much of the oil as possible should be removed from the brush before it is again used for painting.

The Economies of Painting

All the factors in connection with painting or repainting must be carefully followed, so that not only shall the surface to which the paint is applied be thoroughly protected against destructive agencies, but also that the paint film itself shall give the longest life possible under the conditions to which it is exposed. These factors have been pointed out, but before concluding certain salient features should be emphasized, especially as regards the economy of using high quality paint and good methods of application.

At first sight, the application of paint seems to be a costly matter, and for this reason it is often carried out as seldom as possible with cheap materials and in a slap-dash manner, in order to get it over with the least expenditure of time and money. However, a little thought will bring one to realize that with the present high cost of materials of construction and labour, any means that will help to preserve a structure, at a cost that is infinitesimal when compared with the value of that structure, is worthy of the fullest consideration.

The thorough cleansing and preparing of the surface to be painted is an absolute necessity, as, unless the foundation is good, it cannot be expected that the applied paint, however high grade it may be, will have a maximum life. Moisture, dirt or grease on the surface will prevent adhesion of the film, and thus blistering and scaling will result. Rust should be removed scrupulously, as, even though it may look dry, it holds moisture and carbonic acid, and these act on the metal, forming more rust which swells and cracks the paint film. Once cracked, the film allows oxygen and moisture to come in contact with the metal, and thus more rust is formed, and thus the corrosion goes on. No matter what type of paint coating is applied, rust will form progressively under the film if it once gets started and is allowed to remain.

Choose a paint which is designed for the conditions to which it will be subjected. Whether purchased ready mixed or in paste form, specify the type of pigments and vehicles suitable for the purpose. The pigment should be in a very fine state of division; as a rule, very little should be retained on a 325-mesh sieve, and both it and the vehicle should be high grade.

Do not use cheap paint, for it is more costly in the long run. An inferior paint spreads over less surface, because it is made of greater viscosity, since it is necessary to have a thicker film to get the required freedom from porosity and have fair quality. A free working paint of high durability can be readily brushed out, getting better results with greater covering capacity and much economy of time, which reduces the cost of the job by saving in both paint and labour. The actual cost of the paint is a small item when compared with the total cost of the job; in fact, it runs from about 10 per cent to 50 per cent of the total, depending on conditions, the remainder being the labour cost of preparation and application. Extra paintings are a squandering of money, not simply for the paint, but still more for the labour, which is costly, and it is poor economy to save a few dollars on a paint that will last, say, only one or two years, and have to repeat the high labour cost in that short period, when, by using a good paint, costing only a little more, repainting would not be necessary for three or four years or perhaps longer. As an example, suppose for a certain job 100 gallons of paint at $3.00 a gallon were used. By figuring the cost of the paint at an average of 30 per cent and the labour at 70 per cent of the total cost, we get:—

100 gallons paint @ $3.00	$ 300.00
Labour, 70% of the total	700.00
Total cost of the job	$1,000.00

This paint, judging from its cost per gallon, would probably give service for not more than two years, at which time repainting would be necessary. Now, if a more highly durable paint, costing about $4.50 or $5.00 per gallon, had been used it would have increased the cost of the job by only $150.00 to $200.00, the labour charge being about the same, and at the same time would have given protection for at least three or four years without repainting being necessary. Comparing these figures, we find that in the first case we have a cost of $1,000.00 spread over two years while in the second we have a cost of $1,150.00 or $1,200.00 spread over at least three or four years, which is a considerable saving. These figures are conservative, but they serve to illustrate the statement made above, that cheap paint is more costly in the long run.

In applying paints, take care to brush and spread them well. Brushing, when properly carried out, is far superior to spraying or dipping, though these methods are expedient for certain purposes. Good brushing rubs the paint into the pores of the surface to which it is being applied, thus ensuring a better bond and longer life, and at the same time it spreads the paint into a thin film which dries readily into a tough, durable coating. Thick films form a skin on the surface but remain soft underneath. The skin cannot harden, due to the soft paint under it, and the soft paint takes a very long time to dry, due to the skin over it, and in this way paint which is applied in a thick coating lacks durability and has a tendency to wrinkle and lose its smooth appearance. Thick coatings are thus wasteful, and therefore good brushing and spreading, while entailing a little more labour, is economical, not only by saving paint, but also by producing a durable, long-wearing film.

Finally, at the risk of tiresome repetition, the fact should again be emphasized that a little extra expenditure on the thorough preparation of the surface and the use of high quality paint, suitable to the existing conditions and well applied, will be more than compensated for by the durability and long life of the resulting paint film.

Discussion of Paper on Notes on the Forests of Quebec, by G. C. Piché, A.M.E.I.C.*

Mr. Ellwood Wilson, m.e.i.c.

Mr. Wilson drew attention to the fact that the province of Quebec has for a long time been working towards a definite programme which will put its forest industries on a permanent basis. The establishment of a school for training forestry engineers, mainly for government service, had been an excellent piece of work, and the results attained by the forest nursery at Berthierville and in the plantations at Oka were most noteworthy.

He considered that the problem of transportation was probably the most important one before the wood-using industries to-day, men of skill and technical training being certainly needed for this work. He believed that there was much avoidable waste in woods operations, and was of opinion that the work in the woods should receive the same attention and technical skill as is devoted to mill operations. The provincial government was to be congratulated on its policy of limiting the number of mills in the province in proportion to the capacity of the forests, and he hoped that, for the good of the country, this policy would be thoroughly carried out. He pointed out the great amount of damage that can be done by careless or ignorant operation when the forest is originally cut. Such operations should be carefully planned with reference to keeping the forest's productivity on a sound basis, and this work could only be carried out by men of forest experience. He deprecated the system, so common in the United States and Canada at the present time, of practising forestry in the office rather than in the woods. The author of the paper had accomplished admirable work, one of the most useful features of which had been the education, not only of the government, but also of the pulp and paper manufacturers, to the necessity for adequate fire protection and the benefits derived from proper cutting methods and plans for forest utilization.

With regard to fire protection, Mr. Wilson considered that the province of Quebec was on the whole well equipped for the detection of fires, the weak point, however, being the lack of means of getting men and other equipment rapidly to the fires.

He questioned whether the revenue coming in from forests should be turned over to the general funds of the province, pointing out that the trees which have taken years to grow are the stored-up capital of the country; the return obtained by using these should certainly not be treated as current income. He would like to see the whole of the provincial revenue from the forests put back into the forests, so that these great resources would be guaranteed to us for all future time.

Mr. John Stadler, m.e.i.c.

Mr. Stadler was unable to agree with Mr. Wilson in recommending the reinvestment in the forests of the whole of the revenue coming into the provincial treasury from the forests. He believed that a large percentage of the money derived from forest resources should go back for the improvement and maintenance of that valuable asset, but thought it was too much to ask that the whole amount of the revenue should be so used. He trusted, however, that in the future the government would devote a larger proportion of its forest revenue to the improvement and conservation of this great national resource.

The Hon. Mr. Mercier.

The Hon. Mr. Mercier pointed out that last year over $400,000 was spent in the province of Quebec for forest protection alone, and, taking into account the expenditure of $100,000 a year for reforestation, the cost of the nursery at Berthierville, that of the research bureau, and other similar items of expenditure, the province's annual expenditure on forest work reached a very substantial figure; in fact, for the past three years, the amount put at the disposal of his department for forest work had been from $900,000 to $1,100,000 per annum

While noting these facts, he might say that, in his opinion, this expenditure could be increased with advantage to the country, but it was necessary to bear in mind the many calls on the taxpayer and the legitimate demands of other departments.

Mr. Otto Schierbeck.

Mr. Schierbeck thought that Mr. Piché's paper would give the impression that the operating conditions of Canadian forests were in the hands of highly educated, technically trained men, and that these forests were on the highroad to be operated on the basis of a sustained yield. This, he felt, was too favourable a view, as the profession of forestry engineering was now passing through a stage of competition between the technically trained man and the so-called practical man. The papers presented all showed that many important problems awaited the forest engineer.

While pulp and paper mills were run with a high degree of efficiency, and many improvements were invented and installed every year, forest management, surveys and logging operations in the forests were still largely in the hands of non-technical men, the so-called practical woodsmen, and were carried on to a great extent by rule of thumb along the lines employed by the early settlers. There were some notable exceptions, and he wished to take the opportunity of complimenting Mr. LaMothe on his paper, which showed that in some instances new trails were being broken in introducing engineering skill in the handling of logging operations.

When the first settlers came to Canada, they found a virgin forest, in which when trees died of old age they were replaced by a younger generation. When the settlers began to clear the land and lumbermen started to cut the forests, this natural régime was disturbed, especially as cutting and clearing was nearly always followed by forest fires, so that since the advent of the white man Canadian forests had been reduced by 73 per cent. Of this, 13 per cent represented timber which had been cut and 60 per cent that which had been destroyed by fire. Notwithstanding this well-known fact, people still spoke of sustained yield and annual increment. In his opinion, the only way by which an annual increment could be obtained would be by reinvesting some of the capital which was being taken out of the forests every year.

As regards the work of the forestry engineer in Canada, very little experimental work was being carried on, and little had been done as regards working plans based on continuous yield. In Canadian forestry, practically nothing

* This paper was presented at the Annual General Professional Meeting of The Institute, Quebec, February 16th, 1927, and published in The Engineering Journal, February, 1927.

was known about regeneration, protection against damage from fire was inadequate, and great injury was being done to trees by insects. The study of this important subject was in the hands of a staff of entomologists, totally inadequate as regards number, four men having to cover the enormous area from Halifax to Vancouver.

He considered that the profession of the forest engineer in Canada was as yet in its infancy, his work being hampered by misunderstanding and fear of restriction from lumbermen and pulp mill operators, by the antagonism of the practical lumberman who saw his job disappearing, and by the ignorance of the man in the street, who allowed his natural inheritance to be despoiled at an alarming rate.

Mr. Schierbeck welcomed the series of papers presented at the Quebec meeting as being likely to render great service to the Dominion by helping the newest branch of the engineering profession on its way.

Mr. R. L. Seaborne, a.m.e.i.c.

Mr. Seaborne had read Mr. Piché's paper with great interest, and desired to congratulate him on having put so much emphasis on forest protection and forest management. Mr. Seaborne believed that it was the general feeling of foresters that the existing system of forest protection and management, while greatly improved as compared with the past, still left something to be desired.

He was unable to agree with Mr. Wilson that the immediate and most important requirement at present was forest protection only, the question of proper forest management being, in his opinion, even a more pressing one. No one could state at present with assurance what would be a proper scheme of forest management for the province, or for any particular section of it, knowledge as to this being greatly needed. Arrangements that had been successful in Norway, Sweden and Germany would not necessarily fill Canadian needs.

He had been pleased to hear from the Provincial Minister of Forests that a bureau of forest research to study questions of this kind was to be put into operation before long. Those responsible for woods operations would welcome definite facts and information to guide them, so that cutting might be done in such a way that regeneration might be assured without too great an increase in operating costs. He feared that the public was being led to suppose that a perfect forest protection system was now in operation, but did not believe that all of the undoubted success in fire protection during the last few years could be attributed to the system, as weather conditions during the past three years had been unusually favourable to fire protection. In his opinion, more time, money and thought should be spent in improving our fire protection systems than had been the case up to the present.

Mr. R. H. Nisbet.

Mr. Nisbet was of the opinion that the three fundamental requirements for successful forestry work were:—immunity from fire, knowledge of the standing stock, and the assurance that the land upon which the trees stand would remain in forest for a period of at least two rotations.

In regard to the first of these points, a system of fire detection, not entirely prevention, had been developed, and appeared to be sound, but, as pointed out by Mr. Seaborne, it remained yet to be tested, the test coming with the next year of extreme fire hazard; but what was being done to prevent fires? The immunity from forest fires in Sweden, referred to by the author of the paper, had been obtained through educating the people to prevent fires being set. In the province of Quebec, large sums of money were being spent on fire detection, but, in his opinion, sufficient attention was not being given to decreasing the fire hazard by educating the people regarding the evil results to themselves of forest fires. In other words, it would be better to apply to educational methods some of the money now spent in fire detection. He considered it difficult to educate the older generation, because for many years they had been taught that the forest was something that must be got rid of before land could be cultivated, and he believed it much less difficult to teach children through the schools. Such an educational campaign was of great importance, and should not be restricted to newspapers circulated in cities, as for the most part it is to-day.

The next essential was knowledge of standing stock, which could be easily obtained if a sufficient number of technically trained men with proper experience were employed on forest surveys, and if the necessary funds for such surveys were forthcoming.

The remaining essential he considered to be security of tenure for the organizations engaged in lumbering. Such security would necessitate the land now in forests being classified, so as to separate from the forest that portion of it which could profitably grow field crops. He did not agree with the author that inventories must precede classification. Inventories were expensive, and the forest owners could not be expected to spend money upon them unless assured that some advantage would accrue therefrom. He believed that the most progressive step in a provincial forest policy would be to adopt immediately a policy of wholesale land classification, and, based upon that classification, to devote to forest in perpetuity the areas found suitable for the purpose of growing trees. He believed that if this were done the government would find that inventories and forest management would readily follow.

Mr. H. K. Wicksteed, m.e.i.c.

Mr. Wicksteed believed that as regards forest conservation and operation we were living too much on our capital. He drew attention to the serious consequences following the deforestation of a country, particularly with regard to the effect on the drainage and run-off of the rivers and its influence on power developments.

The value of the forest was not only commercial, that of its industrial products, but was also due to its profound and beneficial influence on the life, climate, recreation and progress of the country.

Mr. Henri Kieffer.

Having recently been in touch with conditions in Sweden, to which the author of the paper had referred, Mr. Kieffer believed that the fire loss in that country was much less proportionately than in Canada. This was due to the facts that transportation was easier, there were more roads, very little underbrush, and, further, refuse and tops were collected and made into charcoal.

The public in Sweden was much more highly educated as regards forest protection than was the case in Canada. He did not believe, however, that in Canada we could go as far in educating the public as was done in Sweden. In that country regulations and laws relative to forest protection were more generally followed, and the forests were more closely under government control. For example, in the case of any land pronounced by a government officer as not fit for cultivation, a settler could not cut any timber without permission from the Crown. Forest organizations and local committees existed in practically all districts of Sweden.

He was glad to see that marked progress had been made in the education of young people in the province of Quebec as regards forest protection, and he would urge that particular attention should be paid to the instruction of people from the cities, tourists, and so on, who often travelled through the bush without taking the necessary precautions against fire.

Mr. W. G. Mitchell, M.E.I.C.

Mr. Mitchell congratulated the author on giving such an excellent outline of the work now being carried on in the province of Quebec under the policy initiated in 1922, aiming at the completion of an inventory of the forest resources of the province. Such an inventory should include a classification of the economic potentialities of the timber lands, having in view the setting apart for timber growing those areas economically suitable only for that purpose. With regard to the creation of forest reserves, Mr. Mitchell was of the opinion that bona fide industrial interests with large commitments depending on the forests for their operations would much prefer to bid on new leases on a basis of thoroughly made and comprehensive surveys than to gamble on the uncertainties incident to the fragmentary or incorrect information which to-day was too often the only data available in such cases.

Citing the case of modern pulp and paper mills requiring a capital outlay for physical plant of from $25,000 to $40,000 per ton of daily production capacity or a modern newsprint mill, involving the expenditure of from $35,000 to $60,000 per ton daily capacity, the higher figures including an allowance for the necessary power developments, he pointed out that such enterprises could not be soundly conceived economically on a life expectancy of ten, fifteen or twenty years, but must look forward for a longer period, and were therefore vitally interested in the security of tenure of the leasehold lands upon which their industries were dependent. In a number of cases, land had been withdrawn from timber leasehold and made available for colonization, and when settled and cleared of the timber by settlers had proved so barren that no farmer, however industrious and thrifty, could wring a livelihood from it. The existence of such conditions caused industrial corporations to hope that government policy in the future would take fully into account the lessons afforded by past experience.

Those responsible for the supply of large pulp and paper mills should think in terms of thirty, forty or even fifty years hence, and should plan a forestry and logging operation policy which would ensure an adequate supply of raw material during that time, so arranged that reasonable uniformity of costs could be maintained while providing for the expense of fire prevention and the construction and maintenance of modern transportation facilities.

He believed that if long vision were not being applied to this question in eastern Canada to-day to the extent that should be the case, it was because from the viewpoint of the leaseholder, who might be following a sound forestry policy, no benefit or return available in material form could be expected for a considerable period of years; under these circumstances, no industrial concern dependent upon extensive timber land leasehold could embark on such a policy without very definite assurance of security of tenure over a long period.

The author had referred more than once to Sweden as a country where wood-using industries had a large development, and, in his opinion, the history of Swedish forestry and Swedish wood-using industries afford more lessons of value and interest to eastern Canada at the present time than that of any other country in the world, not even excepting the United States. Sweden had developed a national forestry policy and standards of forestry practice, and these were employed, not only by the state, but also by the large wood-consuming, land-owning and land-leasing interests.

Much of the most important existing forestry legislation in Sweden dated from 1900 to 1905, when growing concern as to the future of the timber resources in the country had led to a revision of older laws and the enactment of many new regulations dealing with the whole question of forest conservation. Within the past twenty-five years a strong national sentiment had developed in Sweden, in support of a sound forestry policy, and one of the most valuable and constructive influences in the forestry situation there was the attitude of the majority of the larger industrial companies owning extensive timber lands.

The total area in Sweden classed as "productive forest land" amounted to approximately 86,500 square miles, of which approximately 65,800 square miles, or, say, 76 per cent of the total timber lands of the country, were owned by private, (individual or corporate), holders. In addition to the area referred to above as "productive forest land," there was a total of approximately 30,500 square miles of so-called "waste areas" of little or no present value as regards timber production, of which 22,400 square miles, (42 per cent), were owned by individuals or companies. The author had stated that the total area of timber lands in the province of Quebec might be taken as approximately 200,000 square miles, of which about 11,000 square miles, (5½ per cent), were referred to as "private forests" held in freehold by various interests, whether individual or corporate.

In Sweden it was the general rule, rather than the exception, for large wood-using industrial interests to regard their forest lands as their fundamental capital, and to recognize that the most efficient development and proper conservation of these was an issue of direct and vital concern to the industries which they support. This attitude on the part of large land-owning interests in Sweden had been one of the most direct and effective instruments in bringing about the conditions existing in that country to-day. He believed that there was real significance in the fact that some 75 per cent of the timber lands of Sweden were actually owned and controlled by private or corporate interests, who had a direct stake in the proper conservation of those resources. He did not suggest that freehold tenure of timber lands on a large scale was possible or even desirable in this country, for in the past history of Canada and the United States there had been many impressive examples of the dangers incident to the complete alienation of the public domain from State control.

He did suggest, however, that the maximum security of tenure of leased lands, compatible with the protection of the public interest, was necessary to secure from large industrial concerns their full effective co-operation in the development of a safe and logical forestry policy.

The development of policies on the part of our government authorities aiming at the creation and maintenance of large forest reserve areas, planned on broadly conceived lines and based in part upon the results of investigation of the natural suitability of land areas for timber growing or other economic use, would be one of the most convincing assurances that could be given to large corporate interests that the real significance of that phase of our forestry problem had been clearly appreciated. In eastern Canada, the problem of the conservation and utilization of our forest resources had in recent years become one of the most important questions directly affecting the economic welfare of the country. The creation of a well-informed and constructive public opinion on such a question would be a slow and difficult development.

This forestry problem had not affected the taxpayer's pocket as yet, and indeed, as the author had stated, a substantial revenue accrued to the provinces from this source; further, much general industrial and commercial prosperity could be directly attributed to the rapid development of wood-consuming industries in eastern Canada in recent years. These obvious and surface evidences were before the public to-day, but there was much graver and more important significance in this situation, as he had attempted to indicate.

Discussion of Paper on Woodlands Management and Operation, by S. L. de Carteret, M.E.I.C.*

Mr. J. V. Perrin.

In Mr. Perrin's opinion, the author had drawn attention to a very important point in mentioning those stands of timber which are mature, or even over-matured, and which are not gaining in value or even maintaining their present value, and in many cases are even deteriorating. Such areas should receive particular attention in classification.

Mr. R. H. Nisbet.

Mr. Nisbet remarked that he could not quite agree with the author's statement that working plans should be made for periods of five or ten years in advance. He believed that this would not be a working plan in the true sense of the term, as a working plan should deal with at least one, or, better, two, rotations of the crop, and should prescribe a method or methods designed to establish reproduction. In Quebec, for mixed spruce and balsam, one rotation would probably be from eighty to one hundred years. Detailed plans dealing with actual logging operations should be based upon the description of such a working plan, and might properly deal with periods of five, ten or twenty years. He felt sure that the author would agree with this statement of the case.

Mr. D. McLachlin, affiliate e.i.c.

Mr. McLachlin pointed out that in the case of white pine areas where crop rotation is at least one hundred and fifty years, it had not been found possible to adopt a working plan and reforestation had not been tried out, on account of the great length of the cycle.

Mr. S. L. deCarteret, a.m.e.i.c.

The author, in reply, pointed out that he had referred in the paper to the necessity of a proper sylvicultural system which would naturally follow, or be part of, the forest inventory, and would be the basis for the actual operating plan. He had treated this subject almost entirely from an operating point of view, assuming that a suitable sylvicultural system had been devised. He believed that every piece of timber land had to be studied by itself, and that no general rule would suit all sections of the country. Having taken a block of reasonable size and worked out the sylvicultural system for that block, the operating plan should be applied to it. He did not think it practical to make a working plan from the operating standpoint, and work it out in detail for more than five or ten years in advance. A complete working plan should show the improvements to be carried out each year, and these would have to be considered, with the varying rates of depreciation and the amount to be written off each year, before the estimated cost of the wood could be arrived at. He considered it very difficult to estimate with any reliability the cost of improvements to be built in the future, if a period longer than five or ten years were taken.

Discussion of Paper on Building an Industrial Plant in the Saguenay District, by John L. Guest, A.M.E.I.C.**

Mr. F. Newell, m.e.i.c.

Mr. Newell remarked that the paper had been of great interest to him, as he had been connected with the work at Arvida. Would the author explain the reasons for using indoor transformers? He believed that these must have been used, as the paper stated that pumps and water for circulating purposes were supplied. He would have thought that outside transformers might have been better for the conditions at Arvida.

Mr. J. L. Guest, a.m.e.i.c.

The author thought that Mr. Lee could probably answer the question, if he would do so.

Mr. W. S. Lee, m.e.i.c.

Mr. Lee pointed out that in a large transformer station quite a number of switching connections were necessary, and they, of course, required housing. It was also necessary to have a very large and adequate crane for assembling and repairs. There were six 25,000-kva. transformers on tracks by which they could be brought under the 100-ton crane and taken over the pit. Thus, it was not so much a question of housing in the transformers as housing in space

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for repairs and accessory equipment, and the building for transformers was not as big as it might seem to be.

The work at Arvida had been constructed very rapidly. In September the oats had been taken off the fields, and the following July aluminum was being made.

Mr. W. G. Chace, m.e.i.c.

Mr. Chace observed that some of the foundation problems experienced in Manitoba had been fairly well described in the author's story about the foundation soil at Arvida. In the Winnipeg aqueduct they had encountered a soil which was practically impervious to the flow of water, having a high moisture content: 50 per cent being quite characteristic. In some areas it was of such a nature that if a ditch should be excavated to a depth of 12 or 14 feet, the weight of the soil along the wall would cause the bottom to rise. The soil was exceedingly plastic, without any grit whatever. Several difficulties of that sort occurred while building the aqueduct and several devices were used in an endeavour to overcome the trouble, such as widening the trench, throwing the earth farther away and distributing the excavated material in order to reduce the over-pressure on the banks of the excavation. Part of the aqueduct had actually been built on a stone raft on the pitchy clay, which was the means of consolidating the soil and carrying the aqueduct burden.

The particular difficulty in the city of Winnipeg was that a water-bearing stratum of sandy material had been found at a depth of from 8 to 12 feet, and throughout the city it was frequently necessary, in designing the foundations of apartment buildings, industrial plants, and so forth, to fix bearing loads not to exceed three thousand pounds per square foot, which was found to be about the maximum allowable, and, on account of the plastic condition of the soil, many of the foundations had to be on the stiffer upper soil and thus better distributed.

With regard to the question of setting of concrete foundations during cold weather, the common practice in Winnipeg was to use manure or straw or hay, or some material of that nature, to protect the exposed trench bottom while the foundations were setting.

Housing was also a common practice. In 1909 the city power plant had been built in that very way; an area of 120 by 200 feet was housed in with a structure 50 or 60 feet high, and with salamanders and boilers and other devices it was made quite practicable to get the very best of concrete work on the banks of the river, and assisted in keeping the construction materials in order.

He had been impressed with the novel method employed in tying together the foundations of the coke storage building in the clay soil. This appeared to be a very wise precaution.

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Circulars to Members

Referring to the disclaimer published in the March number of the Engineering Journal, page 169, the firm in question has addressed a second circular letter to the members of The Engineering Institute of Canada.

Council again desires it to be understood that such improper use of the membership list of The Institute by this firm, or others, is unauthorized.

Members are cautioned against permitting the membership list of The Institute to be used for the promotion of the commercial interests of non-members.

The Institute's Medals and Prizes

On several occasions during the past few years, the attention of Council has been drawn to the fact that the prizes and medals offered for competition by The Institute do not call forth such activity on the part of members as might be expected, and that, more particularly in connection with the Students' prizes, the number of papers submitted from centres other than Montreal and Toronto is very limited.

During the period referred to, the Past-Presidents' Fund has increased in value owing to the liberality of the various past-presidents and has now become available as an additional resource.

Accordingly, in 1926, Council appointed a small committee for the purpose of reviewing and studying the whole situation in The Institute and its branches and making recommendations as to the best method of expending the funds available for medals and prizes.

The preliminary report of this committee has now been presented to, and approved by, Council and is printed in full on page 284 of this issue of the Journal.

The committee has been continued, and has been requested to draw up for the approval of the membership of The Institute a revised set of rules and regulations for the award of The Institute's prizes and medals.

In the preparation of its report, the committee has consulted with all of the branches by correspondence, and has so made its proposals as to leave the branches the fullest liberty in the award of any local or branch prizes which they may see fit to offer in competition. The matter will come up for final discussion and decision at the Annual General Meeting of 1928.

The benefits accruing to The Institute from a well-arranged scheme for the award of distinctions such as prizes and medals are considerable. Such awards are primarily intended to encourage the preparation of original papers, both by senior and junior members, in this way bringing out meritorious communications which would otherwise not be available, and they also afford to the Council of The Institute a means of giving official recognition to members who have distinguished themselves and have rendered noteworthy service to The Institute.

A particularly interesting feature of the report lies in the suggestion that the five Students' prizes awarded by The Institute should be distinguished by being named after various prominent past-presidents of The Institute, thus commemorating these past-presidents' services and their connection with the several zones in which the various prizes are to be awarded.

It will be noted further that the committee recommends that a gold medal named after a prominent past-president should be at the disposal of Council for award on special occasions, when it is desirable to recognize outstanding merit in the profession or distinguished service in the interest of The Institute or of the profession. These conditions would give to the proposed medal a very special value, and would, no doubt, cause it to be a greatly coveted distinction.

It is hoped that The Institute's membership will aid Council in carefully considering the important question of Institute prizes and medals, by studying the committee's report and offering such suggestions or criticisms as will assist in perfecting the scheme.

Address Delivered at the Annual Dinner of The Engineering Institute of Canada, Chateau Frontenac, Quebec, February 16th, 1927

Address of His Excellency Sir François Lemieux, Chief Justice and Administrator, Province of Quebec

Mr. President, Monseigneur, Sir Henry and Gentlemen:—

I feel proud and honoured to attend this elegant and intellectual banquet, and, as Chief Justice and Governor pro tempore, I also wish you, not what is commonly called a cordial welcome, not a Quebec welcome, but something better and above that, I wish to all and every one of you a sincere French welcome.

You belong to a very useful and noble profession.

Engineering is, nowadays, a most interesting art or science. An engineer is a man who must have a full knowledge of and be well acquainted with the principles of mathematics, mechanics, hydraulics, and, indeed, with all the branches of natural philosophy.

Upon you devolves the scientific planning of the construction of public roads, bridges, railways, harbours, drainage works, mining enterprises, military constructions and every line of industrial domain.

Your profession has not only an industrial, but also a national character, because you are an essential element in the economic life of the world.

The future prosperity of nations and, particularly, of Canada and the United States, depends, in a large measure, on eminent engineers and on the hands and brains of the highest type of engineering skill.

Thus, you deserve the most sincere wishes of all for your personal happiness and success in life.

Discours prononcé par Son Excellence Sir François Lemieux, Juge en Chef et Administrateur de la Province de Québec

Ce n'est pas sans hésitation que, dans les occasions même quasi-officielles, je remplace Son Excellence, Monsieur le Gouverneur Pérodeau, qui, par sa bienveillance native et surtout par sa munificence princière, a rendu la tâche redoutable à ses successeurs.

Cependant, je me sens à l'aise et surtout honoré de prendre part à ces agapes intellectuelles et de rompre avec vous le pain bénit de la confraternité professionnelle.

En effet, messieurs les Ingénieurs, vous n'appartenez pas à un état manuel, vous ne faites pas partie d'un métier qui pourrait être honorable, mais vous êtes les membres d'une grande profession libérale.

Dans l'antiquité, les professions libérales étaient closes et fermées et n'étaient composées que des hommes libres et nobles, tandis que les professions industrielles étaient dévolues aux esclaves, aux affranchis et aux étrangers.

Les temps sont changés et vous, messieurs du génie, vous avez obtenu des titres de noblesse professionnelle par le développement intellectuel et par la maîtrise des ces nombreuses sciences utiles à la société et qui rendent à la civilisation des services si appréciables.

Ce n'est pas sans raison qu'aujourd'hui l'on assemble le prêtre, l'homme de loi, le médecin et l'homme de génie, car ces professions sont les grands leviers de la civilisation et représentent la société dans les quatre principaux termes d'existence: la conscience, le droit, la santé et la prospérité.

En effet, le prêtre a la mission sacrée de guérir et de panser les plaies de l'âme et de graver surtout dans la conscience de l'homme de bien l'espoir d'une éternité de bonheur.

L'homme de loi a l'apostolat presque sacré de démêler le juste de l'injuste, de défendre la liberté, la propriété, l'honneur du riche et du puissant, mais surtout du faible et du pauvre qui trouvent, dans le dévouement et la science de l'avocat, un rempart solide contre lesquels l'or et les influences viennent souvent s'effrondrer.

Le médecin, lui, est un des grands bienfaiteurs de l'humanité, car, souvent, il dépense sa vie, avec un sublime dévouement et désintéressement, au chevet des malades, des désespérés et des agonisants, pour soulanger des douleurs et des souffrances.

Le génie, lui, préside aux grandes entreprises nationales, s'associe au progrès de la civilisation qui assure le bien-être des peuples.

Soyez fiers, messieurs, d'appartenir à une confrérie qui, depuis au-delà d'un siècle, a pris une extension si considérable dans le mouvement industriel moderne, soit en matières de communications publiques, canaux, chemins de fer, ponts, digues, dans l'exploitation des mines, dans l'art géologique et aussi dans les constructions de guerre.

Vous appartenez, messieurs, à une profession qui a réalisé des oeuvres titanesques et souvent considérées comme chimériques et irréalisables. L'ingénieur a révolutionné, pour ainsi dire, la face du monde et les pays ne peuvent plus grandir et rester grands sans de grands ingénieurs.

L'art militaire—la dernière grande guerre l'a démontré—requiert le secours constant de l'ingénieur.

Le grand Napoléon ne disait-il pas, à Sainte-Hélène, que si Waterloo avait été perdue ce n'était pas parce que les Français avaient manqué de courage et d'intrépidité, mais parce que le corps des ingénieurs chargé de préparer, en partie, la défense et l'attaque, faisait partie de l'armée de Grouchy qui n'avait pas fait sa jonction avec la sienne.

Tous les grands conquérants, d'ailleurs, Alexandre, César, Godefroi-de-Bouillon, Condé, ont été soutenus dans leurs entreprises militaires et dans leur conquêtes, par des corps d'ingénieurs.

Si vous êtes des professionnels dans le véritable sens du mot, vous avez déjà dû réaliser qu'il vous incombe, tant au point de vue moral que national, de porter avec orgueil le titre de citoyen.

A Rome, le *civis romanus* était rangé parmi les nobles. A son passage l'esclave se rangeait, et il avait droit au salut de César.

On ne peut être citoyen, et c'est là un de ses véritables attributs, sans avoir la qualité dominante de la volonté de contribuer à la grandeur de la patrie.

On ne peut être vrai et loyal sujet de Sa Majesté sans vivre de foi et d'espérance, qui sont les plus robustes auxiliaires de la volonté de l'homme, sans vivre, dis-je, de foi et d'espérance en l'avenir de son pays.

Mais, ne vous contentez pas de vaines espérances, accomplissez celles qui sont raisonnables.

On ne peut être citoyen sans prendre une part virile à la chose publique, car, celui qui meurt sans avoir été citoyen, meurt—excusez-moi l'expression—en état de péché national, et celui-là n'a jamais l'absolution de ses compatriotes.

Le professionnel doit être un éducateur et jeter, par son exemple, et, à l'occasion, par des bonnes paroles, dans le coeur de l'homme du peuple, de l'ouvrier en blouse, des paroles d'espoir et d'encouragement.

Il incombe à l'homme de profession d'enseigner à ses compatriotes le respect des institutions nationales qui ont eu pour base le dévouement, le courage et la haute intelligence de leurs fondateurs.

Dites-leur de se méfier de ces doctrines perverses qui amoindrissent l'esprit public et qui détruisent l'idée vraie d'union et de coopération sur laquelle la Providence fait reposer la société civile.

Enseignez-leur de ne pas prêter l'oreille à ces bruits alarmants, et surtout à ces faiseurs de promesses impossibles à réaliser, et de se méfier de ceux qui amoindrissent et rapetissent notre cher pays, notre chère Province de Québec.

Un grand connaisseur du coeur humain, un homme qui a écrit et parlé toujours pour émouvoir, Lamartine, a dit:—" Il ne faut pas que le peuple souffrant méconnaisse les efforts faits pour produire des institutions secourables, des institutions de charité démocratique, que l'humanité et la religion ont inspiré aux classes intelligentes et dirigeantes." " Car l'oubli," a-t-il ajouté, " est le commencement de l'ingratitude."

Notre peuple est trop reconnaissant pour méconnaître les avantages des établissements d'education, d'asiles de bienfaisance et de santé et les institutions de toutes natures fondées par la charité, le coeur, la munificence publique et privée, et surtout par le patriotisme éclairé de chefs de la nation.

Deux mots de plus et j'ai fini.

Messieurs les Ingénieurs, comme citoyens et professionnels, dressez-vous hardiment devant vos compatriotes et surtout devant les étrangers et répétez la fière parole de Sir Wilfrid, qui est en train de se réaliser à la lettre:—" Que le vingtième siècle sera le siècle du Canada;" affirmez, sans crainte, que l'heure a sonné, que l'heure est arrivée où le Canada, qui est un des joyaux de l'Empire Britannique, a droit de se tenir fièrement à côté des nations et d'avoir une large place sous le soleil du Bon Dieu.

Meeting of Council

Meeting of April 22nd, 1927

A meeting of Council was held at eight p.m. on Friday, April 22nd, 1927, President A. R. Decary, M.E.I.C., in the chair, and nine other members of Council being present.

In connection with the proposed plenary meeting of Council the views of various councillors expressed in correspondence were presented, and after consideration of the replies it was decided that the meeting should be held in Montreal during the third week in October, to last three days; and a small committee was appointed to consider and draw up the agenda for this meeting, such agenda to be submitted to all members of Council before final adoption.

Professor T. R. Loudon, M.E.I.C., as chairman of the committee appointed to consider means by which interest in Institute affairs can best be stimulated among its members reported progress on behalf of his committee.

J. E. N. Cauchon, A.M.E.I.C., reported that, as requested, he had represented The Engineering Institute at the first meeting of the Canadian Engineering Standards Association Committee on Brick Sizes, and that there seemed good prospects of effective agreement being reached with the industry on the reduction of the number of sizes of common and face brick.

The financial statement to March 31st, 1927, was submitted and approved.

A report was submitted from the Board of Examiners in connection with an enquiry received from Council as to whether, in the Board's opinion, an applicant for admission to The Institute who holds the Dominion Land Surveyors' certificate, but who has not graduated from a school of engineering recognized by the Council, or passed the third year examinations in such a course, can properly be exempted from the examinations of Schedule B.

The Board reported that, after discussing the course of study necessary for the Dominion Land Surveyors' certificate, it was unanimously of the opinion that the Dominion Land Surveyors' certificate does not give the necessary assurance of the student's knowledge of elementary physics, mechanics and strength of materials, nor does it cover any requirements for chemistry, for which reasons it cannot be considered as entitling the holder to exemption from the examinations under Schedule B.

J. L. Busfield, M.E.I.C., presented the report of the committee appointed to review and study the question of The Institute's prizes and medals, and the report was approved, the committee being continued and requested to take in hand the preparation of the detailed rules necessary for carrying out its recommendations, these to be brought up at the next Annual Meeting for the approval of the membership. (The report appears on page 284 of the present issue of the Journal.)

A report was submitted from the Legislation and By-laws Committee, recommending the approval of the proposed revised by-laws of the Lethbridge Branch, and approval was accordingly given.

A letter was presented from Past-President Walkem, stating that in view of the number of other important meetings which are to be held in Vancouver this year, the executive committee of the Vancouver Branch considers that it would be well not to hold a Western Professional Meeting of The Institute there until 1928, and Council approved this conclusion.

A letter was presented from the Montreal Branch requesting permission to hold the Annual Professional Meeting for 1928 in Montreal. This suggestion was unanimously concurred in.

The revised design for the Royal Engineers' Memorial Tablet, to be placed on the Cariboo Road by The Engineering Institute of Canada and the Association of Professional Engineers of British Columbia, was submitted and unanimously approved.

A notice of the centennial celebrations to be held at the University of Toronto on October 6th, 7th and 8th, 1927, together with an invitation from the University to The Institute to be represented on that occasion, was presented and noted, and President Decary was requested to act as the representative of The Institute on that occasion.

The names of the officers of the Halifax, Cape Breton and Calgary Branches were submitted and their appointment approved.

The personnel of the Plummer Medal Committee for the current year was submitted and approved.

The recommendations of the Finance Committee in connection with seven special cases were approved.

Two reinstatements were effected.

Seven resignations were accepted.

The following elections and transfers were effected:—

Elections

Member	1
Associate Members	6
Juniors	4
Students	25

Transfers

Associate Member to Member	3
Junior to Associate Member	2
Student to Associate Member	2
Student to Junior	5
Affiliate to Associate Member	1

Twenty-one applications for admission and transfer were scrutinized and classified for the ballot returnable May 20th, 1927.

Six special cases were considered in connection with applications for admission.

The Council rose at twelve-twenty a.m.

OBITUARIES

Donald Cole, A.M.E.I.C.

Regret is expressed at the untimely death of Donald Cole, A.M.E.I.C., which occurred at Detroit, Mich., on December 16th, 1926, following an automobile accident.

The late Mr. Cole joined The Institute as an Associate Member on June 27th, 1922, and at the time of his death was consulting engineer with the Absopure Ice Company, Detroit, Mich. He was born at Baltimore, Maryland, on November 29th, 1885, and received his early education at the Baltimore City College.

Mr. Cole specialized in refrigeration, and was engaged on this work practically throughout his engineering career. His earliest employment was in 1903, when he was draughtsman with The Arctic Ice Machine Company, Canton, Ohio, two years later accepting a similar position with the Frick Company at Waynesboro, Pa. In 1906 he returned to The Arctic Ice Machine Company and for six years occupied various positions, including chief draughtsman, sales engineer and assistant chief engineer. In 1911 he joined the staff of The Timken Detroit Axle Company as assistant engineer, remaining with this company until 1914, when for three years he held the position of chief of plants for The General Ice Delivery Company.

From 1917 to 1920 he was with the United States Army, for the first two years as civilian refrigerating engineer and later as Captain, Q.M. Corps, construction division, in charge of all army cold storage and ice-making plants. In 1920 he entered consulting practice, specializing in refrigeration, and had an office at Windsor, Ont.

Alvah Seymour Going, M.E.I.C.

It is with regret that we record the death of Alvah Seymour Going, M.E.I.C., which occurred at his home in Montreal on March 21st, 1927.

The late Mr. Going was terminal engineer with the Bureau of Economics of the Canadian National Railways, to which position he was appointed on April 1st, 1923.

He was born at Portland, Oregon, on April 7th, 1860, and commenced his engineering work with the Seattle Lake Shore and Eastern Railway in 1886. Subsequently, he was employed by the Northern Pacific Railway and Great Northern Railway and as chief engineer of the Port Crescent Harbour Improvements. He was also at one time reconnaissance engineer with the Grand Trunk Railway and division engineer of the Minneapolis and St. Louis Railway. In 1907 he joined the Grand Trunk Railway staff at Montreal as locating engineer, continuing in that capacity until 1910 when he became engineer of construction, which position he occupied until his appointment as terminal engineer with the Canadian National Railways.

The late Mr. Going joined The Institute as an Associate Member on May 20th, 1892, and transferred to Member on May 14th, 1910.

PERSONALS

T. H. Hogg, M.E.I.C., chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, has been appointed member of the Lake of the Woods Control Board.

Major P. Earnshaw, D.S.O., M.C., A.M.E.I.C., who has been with the Department of National Defence at Camp Borden, Ont., is now attending the Royal Staff College, Camberley, England.

W. E. Hall, A.M.E.I.C., formerly on the engineering staff of the Anticosti Corporation, Three Rivers, has accepted a position as engineer and construction superintendent to build a railroad at Chevrie, N.S., to haul gypsum from the quarry to tide water.

Professor Duff A. Abrams, M.E.I.C., whose resignation from the directorship of the research laboratory of the Portland Cement Association was announced in last month's Journal, is now director of research of the International Cement Corporation, New York City.

T. R. Emerson, S.E.I.C., is located at Toronto with the Canadian National Railways on the terminal engineer's staff with H. L. Currie, A.M.E.I.C., on the construction of the new engine and car facilities. Mr. Emerson graduated from the University of Toronto in 1924.

F. H. Dentith, S.E.I.C., who graduated from McGill University in 1925, has joined the engineering staff of the Bell Telephone Company of Canada and is in the machine switching engineering equipment division. Following graduation, Mr. Dentith was junior chemist with the Brandram-Henderson, Limited, Montreal.

W. T. D. Ross, S.E.I.C., who graduated with the degree of B.Sc. from McGill University in 1926, has accepted a position as chemist with the Canadian Explosives, Limited, Nobel, Ont. Mr. Ross won a Students' prize in chemical engineering this year for his paper entitled "Salt Mining in Nova Scotia—A new Industry."

J. W. Lewis, Jr.E.I.C., has resigned from the staff of the Canadian Pacific Railway Company, New Brunswick division, to accept a position with the Portland Cement Association, Chicago, Ill. From 1914 to 1917 he was on the engineering staff of the Department of Public Works of Canada at St. John, N.B.

J. J. McNiven, A.M.E.I.C., has been appointed to the sales staff of the General Supply Company of Canada at Montreal. Mr. McNiven graduated from McGill University in 1912 and for some twelve years was with the British Columbia Electric Railway Company engaged in design, construction and operation in connection with the hydro-electric steam power plants of that company.

D. C. Macpherson, S.E.I.C., of the Dominion Bridge Company, Limited, has been transferred from East Templeton, Que., to Quebec City. Mr. Macpherson is a graduate of Queen's University of the year 1924. He has been with the Dominion Bridge Company, Limited, on the construction of the Gatineau mill of the Canadian International Paper Company, and is now on the construction of the Limoilou mill of the Anglo-Canadian Paper Mills, Limited, at Quebec.

A. D. Ross, A.M.E.I.C., assistant engineer of the Wayagamack Pulp and Paper Company, Limited, Three Rivers, Que., since 1925, has joined the staff of the Canadian Comstock Company, Limited, Montreal. Mr. Ross is a graduate of the Massachusetts Institute of Technology, from which he received the degree of M.Sc. in electrical engineering. Following graduation, he took the students' engineering course with the General Electric Company, later being appointed electrical engineer with this company, specializing in paper mill work.

F. D. Farnsworth, A.M.E.I.C., resident engineer with the State Highway Commission of Maine, has been appointed town manager of Fort Fairfield, Maine. From May 1913 until December 1914 he was assistant engineer to the late H. N. Ruttan, HON. M.E.I.C., Winnipeg, Man. For the next three years he was on the engineering staff of the Canadian Overseas Railway Construction Corps, following which he was connected with the Nova Scotia Provincial Highway Board. He was chief engineer of the firm, Reid, Farnsworth and Shafner, Limited, from 1920 until 1926, when he was appointed to the position from which he has just resigned.

A. L. Mudge, M.E.I.C., of Toronto, Ont., has been appointed senior electrical engineer for the Welland Ship Canal with headquarters at St. Catharines. For the past few years, Mr. Mudge was located in Ottawa as power plant engineer on the staff of the Canadian section of the Joint Board of Engineers for the St. Lawrence Deep Waterways Project, prior to which he was for many years actively engaged in private practice with the firm of Kerry and Chace, Limited, consulting engineers, Toronto, with which firm he devoted most of his time to water power development and industrial electrical engineering work.

R. S. Baker, A.M.E.I.C., who has recently been engaged on the installation of the Thorne continuous bleaching system for the Mattagami Pulp and Paper Company, now known as the Abitibi Fibre Company, is at present located at Temiskaming as research engineer with the Riordon Pulp Corporation, Limited. Mr. Baker previously occupied this position, together with that of assistant mill engineer, with the Riordon Corporation. Following his service overseas, Mr. Baker was appointed engineer with the Wayagamack Pulp and Paper Company at Three Rivers, at which time he was engaged on construction work in connection with the woods operation.

G. C. Read, A.M.E.I.C., has been located in England for the past twelve months, and is at present resident engineer for the city of Birmingham on the construction of the first super-power station in that city. Mr. Read was for a number of years in Halifax connected with the engineering staff of the Provincial Highways Board of Nova Scotia. He is a native of England, and received his education at London University, Kingston Technical College and Regent Street Polytechnic. On coming to Canada in 1911, his first work was with the Canadian Pacific Railway Company on maintenance, location and construction. Subsequently, he worked at various points in Canada in connection with railway work.

W. R. Warren, A.M.E.I.C., Deputy Minister of Telephones in Saskatchewan

W. R. Warren, A.M.E.I.C., until recently chief engineer of the department of telephones, Saskatchewan government, has been appointed deputy minister of telephones of Saskatchewan to succeed the late D. C. McNab.

Mr. Warren's connection with the provincial telephone system of Saskatchewan dates back to August 1908, when he was appointed engineer of the system. In 1912 he was promoted to chief engineer, and in this capacity has been in charge of the construction, maintenance and operation of the system ever since. Prior to coming to Saskatchewan he was local superintendent in charge of construction, maintenance and operation of telephone system in Winnipeg.

G. C. Perkins, A.M.E.I.C., Engaged on Work in India

G. C. Perkins, A.M.E.I.C., who has been in India for the past two years, is assistant bridge engineer with the North Western Railway and is located at Attock, Punjab, India, where he is engaged on the reconstruction of the Attock bridge.

Mr. Perkins was born in India and received his education in England. He spent a number of years in Canada, with the Railway Signal Company of Canada at Lachine, Que., in 1911-12, and for the next three years on railway surveys, first with the Canadian Pacific Railway and later with the Canadian Government Railways. During part of the war he was with the Imperial Ammunition Board as gauge inspector, later going overseas and serving in France. Upon his return to Canada, he was engaged in various construction works.

C. V. von Abo, Jr.E.I.C., Located in South Africa

C. V. von Abo, Jr.E.I.C., whose thesis on "The Present Status of Our Knowledge of Secondary Stresses in Bridges" earned for him the degree of Ph.D. from McGill University in 1922, has since that date been in South Africa, where from January 1923 to June 1925 he was connected with the staff of the Cape Technical College at Cape Town. Since that time he was attached to the department of the chief civil engineer of the South Africa Railways as research officer engaged on special investigations. At the present time he is temporarily connected with the bridge department of the South Africa Railways for a period of six months, after which he will return to his former position.

Mr. von Abo is a native of Orange Free State, South Africa, and received his degree of B.A. from the University of Cape of Good Hope in 1913 and the following degrees from the University of Cape Town:—B.Sc. in civil engineering in 1917; M.A. in pure mathematics in 1918 and M.A. in applied mathematics in 1919.

J. A. Beauchemin, A.M.E.I.C., Appointed Town Manager

J. A. Beauchemin, A.M.E.I.C., has been appointed town manager for the new town of Dolbeau in the county of Lake St. John, Que. The townsite of Dolbeau is being developed by the Lake St. John Power and Paper Company, Limited.

Mr. Beauchemin graduated from the University of Montreal in 1911 and was assistant engineer in the hydraulic division of the Department of Public Works, Ottawa, from 1911-18, when he joined the staff of the Riordon Pulp Corporation, Limited, at Temiskaming, Que., as assistant to the chief engineer in charge of hydro-electric power investigations. In 1920 he resigned from the Riordon Corporation and became associated with the Donnacona Paper Company, later becoming mill engineer for this company and remaining in that position until 1926. He was then appointed mill engineer on maintenance and construction with the Port Alfred Pulp and Paper Corporation, Port Alfred, Que., with which company he remained until his present appointment.

Dr. J. B. Porter, M.E.I.C., Retires

Dr. J. B. Porter, M.E.I.C., will retire from the chair of the mining engineering at McGill University at the close of the college session, according to a recent announcement.

Dr. Porter's connection with McGill covers a period of some thirty years, commencing with his appointment as

Macdonald professor of mining and metallurgy in 1896, when that department was inaugurated. In 1904 he became professor of mining and director of the department.

He is a graduate of Columbia University of the year 1882, from which he received the degree of E.M. During the following year he was engaged as instructor in mining at the University of Cincinnati, and in 1884, as the result of a study of the economic geology of the coals and iron ores of Tennessee and Alabama, he obtained the degree of Ph.D. from Columbia University. During the following twelve years he was engaged in provincial work, holding many positions of responsibility.

Dr. Porter was elected a Member of The Institute on December 3rd, 1896, and served on the Council during the years 1904 to 1906. He is a member of the council and chairman of the Canadian Advisory Committee of the Institution of Civil Engineers of Great Britain; corresponding member of the council of the Institute of Mining and Metallurgy of Great Britain; one of the founders and past-president of the Sigma Xi Society of McGill University; and one of the founders of the Canadian Engineering Standards Association, of which he is vice-chairman.

In 1905 he received the honorary degree of D.Sc. from the University of Cape of Good Hope on the occasion of the visit of the British Association for the Advancement of Science to South Africa. He has been a member of the Canadian Institute of Mining and Metallurgy since its incorporation and served on its council for many years and as vice-president in 1907-08.

Dr. Porter has written a number of books and papers dealing particularly with coal and was the senior author of "Investigation of the Coals of Canada," which was published in six volumes, about fifteen years ago, by the Mines Branch of the Department of Mines.

EMPLOYMENT BUREAU

Situations Wanted

CIVIL ENGINEER

Open for an engagement about May 20th, M.E.I.C., returned soldier, twenty-five years experience in all parts of Canada and United States; railway location and construction, canals, concrete structures, sewers, water systems, buildings, highway location and construction, all classes of pavements; experience as engineer-in-charge and superintendent for contractor. Apply box No. 225-W, Engineering Journal.

ELECTRICAL ENGINEER

B.A.Sc., University of Toronto. Two years testing with large electrical company. Three years in engineering department on design of railway control apparatus. Desires new connection with firm located in central Ontario. Employed, but available on few weeks notice. Apply box No. 226-W, Engineering Journal.

Situation Vacant

ELECTRICAL OR MECHANICAL ENGINEER

A large public service corporation requires the services of an electrical or mechanical engineer with several years experience. The work is of a technical nature and offers good possibilities for advancement. Apply box 167-V, Engineering Journal.

Members' Exchange

TRANSIT FOR SALE

One Troughton and Simms transit theodolite, on three levelling screws, 6½ inches horizontal circle, 5-inch vertical circle, both graduated to twenty minutes, reading to twenty seconds. Three-inch circular needle, English form tripod; good condition. Also one surveyors' compass, 4-inch needle, 5½-inch sights, 12½ inches apart; all in box, fitted for jacob staff. Can be used on tripod; good condition. Apply to E. T. Wilkie, M.E.I.C., 56 Marmaduke Street, Toronto, Ont.

ELECTIONS AND TRANSFERS

At the meeting of Council held on April 22nd, the following elections and transfers were effected:—

Member

NOYES, Donald Franklin, B.S., (Clarkson College of Tech.), supt. of constrn. for Quebec Devel. Co., Duke-Price Power Co. and Alma & Jonquiere Ry., Isle Maligne, Que.

Associate Members

BIRKETT, Leonard Harris, sales engr., Superheater Co., Ltd., Montreal, Que.

CALLANDER, Delmer Wallace, B.Sc., (McGill Univ.), transformer design, Can. Westinghouse Co., Hamilton, Ont.

CARNWATH, James, B.Sc., (McGill Univ.), manager, Independent Concrete Pipe Co., Ltd., Woodstock, Ont.

LOTIMER, James Stanley, supt. of elect'l mtce., Niagara District, Niagara Falls, Ont.

TREGARTHEN, Mark Elmer, B.E., (Sydney Univ.), with Comstock at Gatineau paper mill, Hull, Que.

WEBSTER, James Clarence, A.B., (Western Reserve Univ.), sales engr., Can. Nat. Carbon Co. and Prest-O-Lite Co. of Can., Ltd., Toronto, Ont.

Juniors

ASHBY, Reginald Beale, B.Sc., (McGill Univ.), engrg. staff, Foundation Co. of Can., Ltd., Montreal, Que.

GIBBON, Hubert Stuart Vroom, engr. with Quebec Devel. Co., Isle Maligne, Que.

PHILLIPS, John Bernard, 4th year applied science, McGill Univ., Montreal, Que.

WICKWIRE, James Leander, B.Sc., (McGill Univ.), grain elevator design work with C. D. Howe & Co., Port Arthur, Ont.

Transferred from class of Associate Member to that of Member

GRANT, LeRoy Fraser, B.Sc., (Queen's Univ.), associate prof. of engrg., R.M.C., Kingston, Ont.

ROBINSON, Leonard Hiram, C.E., (Univ. of Toronto), div. engr. mtce. of way, C.N.R., Campbellton, N.B.

WALL, Arthur Stanford, i/c plate and tank dept., Dom. Bridge Co., Ltd., Montreal, Que.

Transferred from class of Junior to that of Associate Member

DUNBAR, John Robert, B.Sc., (McGill Univ.), i/c a.c. generator and synchronous motor design, Can. Westinghouse Co., Hamilton, Ont.

HENRY, Thomas Haliburton, B.Sc., (McGill Univ.), supt., A. F. Byers & Co., Ltd., Montreal, Que.

Transferred from class of Student to that of Associate Member

MacISAAC, Vernon, W. B.Sc., (Queen's Univ.), ch. engr., Howard Smith Paper Mills, Cornwall, Ont.

McCULLOCH, Orval James, B.Sc., (McGill Univ.), asst. structural engr., Welland Ship Canal, St. Catharines, Ont.

Transferred from class of Student to that of Junior

DAVIES, Ewart John, B.Sc., (N.S. Tech. Coll.), with Babcock-Wilcox & Goldie-McCulloch, Ltd., Galt, Ont.

HARVIE, Allin C., B.Sc., (Queen's Univ.), inspector on constrn. work, instrumentman and dftsman, engrg. dept., Int. Nickel Co. of Can., Ltd., Port Colborne, Ont.

KINGSTON, Thomas Martyn Sibbald, B.A.Sc., (Univ. of Toronto), field engr., Fed. Portland Cement Co., Buffalo, N.Y.

RAPLEY, Blake P., B.Sc., (Queen's Univ.), dftsman, Imperial Oil Refineries, Ltd., Sarnia, Ont.

WEBB, Harry Randell, M.Sc., (Univ. of Alta.), lecturer in civil engrg., Univ. of Alta., Edmonton, Alta.

Transferred from class of Affiliate to that of Associate Member

EISENHAUER, Erle Eli, B.Sc., (Univ. of Sask.), irrig. specialist with Alta. government schools of agriculture, Claresholm, Alta.

BOOK REVIEWS

Movable Bridges

Vol. I, Superstructure, Vol. II, Machinery

By Otis Ellis Hovey, John Wiley & Sons, New York, 1926. Cloth, 6½ x 9½ in., 352, 344 pp., illus., figs., tables, $6.00 per vol.

The first impression produced on the reviewer by a careful reading of Hovey's Movable Bridges is one of completeness. It would seem that nothing remains to be said, and that notwithstanding the author's admitted limitation to United States practice and American Bridge Company design, the whole field is well and ably covered. The principles given, whether of analysis or of economy, are universal in their application, and it only remains for the responsible engineer using this text as a reference book, to appraise properly his own local and governing conditions, when considering the questions of type of bridge, type of power, and general details, structural or mechanical.

The critical and comparative surveys of the various species of movable bridges, their subdivisions and particular examples, are especially to be commended as being sound and fair beyond cavil. The long and intimate experience of the author endows these observations with a weight of authority not previously obtainable in published texts. It is gratifying to find such definite confirmation of personal conviction regarding the inherent superiority of swing-spans, where local circumstances do not rule them out. The unfortunate fact that swing spans alone involve no proprietary features has led many public authorities, and not a few engineers, to neglect them in favour of "modern" types generally advocated with all the advantages of "modern" salesmanship.

To Canadian engineers, the items of freight, duty, minimum of attention after erection in inaccessible districts, and the susceptibility to manufacture in the greater number of Canadian shops are other features which operate still further in favour of the lighter, simpler types with the minimum of complex machinery or machined parts.

The second impression is rather different in nature and arises from the too general use of the term "draw." Very few existing, and virtually no new, movable spans are "draw-spans," and the term ought to be discouraged in present day literature.

The historical review in volume I, although brief, is of considerable interest and evinces very wide and painstaking research on the part of the author.

Some very valuable tables and curves are given in the chapters on superstructure design, but the reader should use only with judgment those such as 3-V and 3W where the data are very sketchy in relation to the resulting graphs.

Chapter IX, on deflections, is a well arranged and concise presentation of general principles and comparative methods, and in table 9-H contains a most informing selection of figures regarding turntables. As is usually the case where analytical material is included in the text, some corrigenda have escaped the proofreader.

The treatment of end-lifting mechanisms and their duties in chapter X is clear and broad. The examples are well chosen and the criticism is again sound and fair. Perhaps the paragraph on page 273 dealing with swinging clearance could, with advantage, be revised to state more directly that the details at the end of the span and on the abutments should be so designed as to provide swinging clearance under all possible conditions of temperature and teetering about balance wheels when wedges are withdrawn, etc. The same chapter discusses centre bearings, discs, pinions, live-rings, and offers pertinent and valuable hints to the mechanical-design office. The author definitely prefers two discs to three and refers to the European practice in this regard, although it would appear from the illustrations that for larger spans in the United States, as here, three discs is the commoner arrangement. Incidentally, it is at least doubtful whether French engineers had arrived at "steel discs" in 1625, as the text suggests on page 13.

The appendices are interesting though not conclusive. That which treats of disc radii and disc pressures seems to the reviewer to be rather more fortunate in its results than rigid in its analysis. On page 337 when evaluating a mean E the use of "dia." for diameter, instead of "d" (in two fonts) would render the comprehensibility rather more facile. On page 338 the last equation but one needs restating to show that x = 11.145 inches.

The other appendix, dealing with line contact between segmental treads and track girders, is admittedly incomplete, although indicative of much serious thought along productive lines. It can hardly be interpreted as providing a full solution of those continually recurring problems as to where contact stops and how the pressure varies within the limits of contact. The author's discussion and the investigation to which he refers will nevertheless be very welcome steps toward a practical method of providing for the really serious loading conditions which occur on rolling-lift segment-to-track surfaces.

Volume II treats mainly of the design of operating machinery and is adequately illustrated by views of actual bridges. After an introduction where observations, based on wide experience, are given on the theoretical and practical problems involved, the author proceeds to a recital of the work to be performed by the power applied, and then to typical cases of swing, bascule, and lift-span installations. Some very interesting examples of long and useful service by swing-span machinery are instanced, drawing attention to the advantage of simple layout, careful workmanship and proper maintenance. The obvious misprint of a date under figure 3-0 will not confuse the thoughtful reader. A very comprehensive discussion on bearing metals occurs in chapter IV, reference being made to the various alloys and their properties, both as revealed by miscroscopic examination in the metallurgical laboratory and by actual service tests.

The resistances in the machinery itself are then taken up, followed by chapters on the individual parts, such as shafts, journals, gears, cranks, springs and sheaves. A most interesting analysis on wire ropes as used in vertical lift bridges is presented in chapter XII, with particular reference to the use of the elastic modulus of the built-up rope rather than that of the metal in the wires.

The next matter treated is the usually troublesome question of brakes, after which the author offers a few ideas on the details of hydraulic machinery parts. A separate chapter is devoted to unit stresses permissible on the various materials which enter into the mechanical construction, and in appendix A appears a complete set of specifications covering superstructure and machinery design for all types of moving spans. Arranged on the general lines of the A.R.E.A. specification, this set of rules and requirements furnishes a mine of information, sufficient with but few modifications for the guidance of, or even the adoption by, any engineer called upon to prepare plans or designs, where the specification is not already standardized.

Appendix C contains a multitude of tabulated data, some being of the usual handbook type but elaborated, others being of a more rarely compiled nature, for instance, the elastic properties of loaded cantilever columns, and the geometrical tables 6 to 11. They are all expressed clearly and the printing is generally equally satisfactory. In table 3, on page 308, a note should be added to indicate that the curve dealt with in the third figure is a parabola only.

Taken together, the two volumes comprise a masterly treatment of the subject, replete with information, yet not overloaded with unnecessary or elementary detail, and they will constitute a more than ordinarily useful addition to the working library of those engineers who are regularly engaged in, or occasionally consulted upon, the design of movable bridges.

P. L. Pratley, M.E.I.C.
Consulting Engineer, Montreal.

CORRESPONDENCE

Interim Report of the Committee on The Institute's Prizes and Medals

(Presented to the Council April 22nd, 1927)

To the President and Members of Council,
The Engineering Institute of Canada, Montreal.
Gentlemen:—

Your Committee on Prizes has made a careful study of the subject of awarding prizes by The Engineering Institute and its branches.

Briefly, the present situation is that The Institute awards:—

The Gzowski Medal for the best paper in any one year;

The Leonard Medal for the best paper on a mining subject.

(This is a joint medal with the Canadian Institute of Mining and Metallurgy.)

The Plummer Medal for the best paper on a metallurgical or chemical subject; further:

Five Student prizes, each twenty-five dollars cash, are awarded, one in each of the five sections, namely, general, mechanical, electrical, mining and chemical.

Branch prizes are or have been awarded by the Vancouver, Winnipeg and Hamilton Branches. The Saskatchewan Branch offers a scholarship to the most deserving member of the graduating class in engineering of the University of Saskatchewan. The practice of awarding prizes is not sufficiently general among the branches to have more than a passing bearing on the broad policy of The Institute.

Your committee has been in communication with every branch of The Institute, many of which have sent in recommendations which have been used as a basis for the recommendations which follow.

Recommendations.

No change can be made regarding the Gzowski, Leonard or Plummer medals.

Instead of the five Student prizes now awarded of twenty-five dollars each, your committee recommends that five prizes be awarded, distributed geographically by vice-presidential zones as follows: one for Zone A, the four western provinces; one for Zone B, the province of Ontario; two for Zone C, the province of Quebec; one for Zone D, the maritime provinces. Two prizes are recommended for Zone C, the province of Quebec, in view of the fact that 50 per cent of the student membership is in this province; further, in view of the fact that there are both English and French universities, it is recommended that one prize should be English and one French. Each prize should be in the form of books or instruments to be selected by the recipient to the value of twenty-five dollars. It is also recommended that each prize be named after a prominent past-president of The Institute from the territory in which the prize is to be awarded. For example, the Ontario prize might well be called the *John Galbraith Prize*. Names should only be allocated after very careful consideration, and after conferring with representatives of the zones. The present arrangement whereby Juniors are eligible for Student prizes should be continued.

Your committee recommends that a new prize in cash, of one hundred dollars, be awarded annually for the best contribution submitted by any member of The Institute on a subject selected by Council and announced at the commencement of each year. It is recommended that this prize be called *The Past-President's Prize*, in recognition of the fund established by past-presidents.

Your committee also recommends that a gold medal named after a prominent past-president, such as, for example, *The Sir John Kennedy Medal*, might be awarded, only when the occasion warrants, as a recognition of outstanding merit in the profession or of noteworthy contribution to the benefit of The Institute or of the profession. This prize should be looked upon as of such outstanding value that it would only be awarded occasionally and limited to corporate members. It is suggested that each branch should be asked for recommendations every year, but that Council should only make the award if it considers the occasion warranted.

The foregoing recommendations are submitted for your consideration as indicating the broad principles only. It is suggested that if these principles meet with the approval of Council a set of rules be very carefully prepared and in such rules there would be incorporated a very definite specification under which the prizes should be awarded.

Yours very truly,

COMMITTEE ON PRIZES.

Per J. L. BUSFIELD, M.E.I.C.,

Chairman.

Committee:—
J. L. BUSFIELD, M.E.I.C., Chairman.
GEO. R. MACLEOD, M.E.I.C.
A. FRIGON, A.M.E.I.C.

Lincoln Arc Welding Prizes

The American Society of Mechanical Engineers have just published a bulletin entitled "Conditions Governing the Award of Lincoln Arc Welding Prizes," containing details regarding the award of these prizes.

The Society has accepted the custody of $17,500 given by the Lincoln Electric Company of Cleveland, Ohio, as prize money in connection with this competition, a preliminary announcement of which appeared in the February issue of the Engineering Journal.

All enquiries for further information should be addressed to the secretary, Calvin W. Rice, The American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York, N.Y.

Trade Publications

The Canadian S.K.F. Company, Limited, have issued a conversion table chart giving the decimal equivalent parts of an inch in six figures. This chart is available in two sizes,—one 30" x 26" and the other 8" x 5",—and should prove useful to those whose work frequently requires the conversion of fractions of inches to decimals. Copies may be secured from the company's office at 1057 Bay Street, Toronto, 5, Ont.

Western Wheeled Scraper Company, Aurora, Ill., have issued an instructive and interesting souvenir booklet entitled "Fifty Years of Service," containing details and illustrations of the application of this company's equipment to various engineering construction works.

The Garlock Packing Company announce the removal of their general office from Hamilton, Ont., to New Birks Building, Montreal, and, while the company's general factory will be located in Hamilton, all business will be transacted through their office at Montreal.

BRANCH NEWS

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

ANNUAL MEETING

On Saturday, March 12th, the annual meeting of the branch was held following a luncheon, when some thirty members were present.

Reports from the conveners of the various committees were read and duly adopted. It was shown that the attendance throughout the season had been quite satisfactory. The secretary-treasurer's report showed that the membership had dropped slightly but was keeping up to the average for the past few years. This is to be expected in a city such as Calgary, where, comparatively speaking, very little actual engineering work takes place. His financial report was clear and gratifying, especially as a fair balance was showing to our credit in the bank. It is felt that the secretary gets very little thanks in proportion to the amount of real hard work he does. The branch members, of course, show their appreciation, but would like also to express it through our columns in the Journal.

Following the work of the scrutineers who counted the ballots, Chairman J. H. Ross, A.M.E.I.C., announced the election of officers of the branch for the ensuing year as follows:—

Chairman	F. K. Beach, A.M.E.I.C.
Vice-Chairman	Thos. Lees, A.M.E.I.C.
Secretary-Treasurer	H. R. Carscallen, A.M.E.I.C.
Executive Committee	F. M. Steel, M.E.I.C.
	F. J. Robertson, A.M.E.I.C.
	J. J. Hanna, A.M.E.I.C.
Auditors	O. H. Hoover, A.M.E.I.C.
	J. C. Milligan, A.M.E.I.C.

As previously announced, the branch has been honoured again by the election of one of its members, in the name of S. G. Porter, M.E.I.C., to the office of western vice-president of The Institute. A. L. Ford, M.E.I.C., is the new representative of the branch on this year's Council. W. St. J. Miller, A.M.E.I.C., has been elected as a member of the Papers Committee at Headquarters.

Chairman Ross delivered a short and appropriate farewell speech before retiring, and handed the leadership of the branch over to the new chairman, F. K. Beach, A.M.E.I.C., who spoke briefly but to the point, and thanked the members for the honour they had bestowed on him by his election.

Halifax Branch

Harry F. Bennett, A.M.E.I.C., Acting Secretary.

Through the kindness of Dr. F. H. Sexton, of the Nova Scotia Technical College, the members of the branch were permitted to see several excellent motion pictures covering the subjects of oil, asbestos and water power, shown at the Technical College on April 1st.

These films were prepared by the United States Bureau of Mines, and were of an unusual educational value. The story of oil dealt fully with the subject, including the boring, its purification and the wide use of its products. The asbestos film depicted mining operations in Arizona and Quebec and its manufacture. A part of the film dealt with magnesia, with which asbestos is closely associated in the arts.

CARBONIFEROUS LIMESTONES AND COAL MEASURES IN NORTH WESTERN EUROPE

Canon Delepine, professor of geology at the University of Lille, France, visited Halifax on April 4th, and lectured at Dalhousie University on "Carboniferous Limestones and Coal Measures in North Western Europe." The members of the branch were invited and availed themselves of the opportunity of hearing Canon Delepine.

He dealt with the several geological periods when coal and limestone were formed, and by splendid illustrations showed the parts of Europe where these deposits are found. The origin of the coal measures and the relation of the North American coal fields with those of Europe were traced through the organisms found in the various deposits. The members of The Institute appreciated the privileges extended to them by the two local universities.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, Jr.E.I.C., Branch News Editor.

Regular Meeting, March 16th

A meeting of the Hamilton Branch was held in the cafeteria of the Hamilton Technical Institute on Wednesday, March 16th, 1927, at 8.15 p.m., with L. W. Gill, M.E.I.C., presiding. Approximately thirty were present.

The report of the nominating committee was read and after amendment was adopted.

The present executive committee, composed as follows, is continuing in office for the next year:—

Chairman ....L. W. Gill, M.E.I.C.
Vice-Chairman ....W. L. McFaul, M.E.I.C.
Secretary-Treasurer ....W. F. McLaren, M.E.I.C.
Executive Committee .....H. A. Lumsden, M.E.I.C.
G. R. Marston, A.M.E.I.C.
F. P. Adams, A.M.E.I.C.
Arthur H. Munson, A.M.E.I.C.
Branch News Editor ....J. R. Dunbar, Jr.E.I.C.
Past Chairman ....C. J. Nicholson, A.M.E.I.C.
Past Secretary-Treasurer....H. B. Stuart, A.M.E.I.C.

The following Hamilton Branch Prize Committee were appointed:—

Chemical Section ....H. G. Girvin.
Civil Section ....E. H. Darling, M.E.I.C.
Mechanical Section ....W. G. Milne, A.M.E.I.C.
Engineering Education .... L. W. Gill, M.E.I.C.
Electrical Section ....D. W. Callander.

A. M. Jackson, A.M.E.I.C., then addressed the meeting on "The Use of the Local Material for Concrete Construction." He described the methods of inspection whereby it was possible to use local materials in the construction of concrete roads in Brant county, thereby effecting a considerable saving over the use of outside materials. He mentioned the procedure of predetermining the strength of the concrete.

Mr. Jackson's paper is the first paper which has been presented before the Hamilton Branch to be eligible for a Hamilton Branch prize, and it is hoped that several more papers will be entered in the competition during the coming year.

G. R. Marston, A.M.E.I.C., discussed the paper and suggested a comparison between the Hamilton-Toronto concrete highway and the asphaltum surface of Dundas street. F. P. Adams, A.M.E.I.C., when moving a vote of thanks, commended the work done by Mr. Jackson. The vote of thanks was seconded by H. A. Lumsden, M.E.I.C., and was carried.

Stanley Shupe, M.E.I.C., then gave an excellent address on the "Sewage Disposal Plant at Kitchener," which has special difficulties to contend with on account of the waste from the tanneries and abbatoirs. The first method used was the distribution method by spreading over ploughed land. They next went to sand filtration and finally the Imhoff tank was adopted.

Mr. Adams also contributed to the discussion on this paper. A vote of thanks was moved by Mr. Marston and seconded by W. L. McFaul, M.E.I.C.

Mr. W. H. Mackie, of the Ontario Tractor Company, Toronto, showed moving pictures of the caterpillar tractor clearing snow from the streets and levelling roads.

Refreshments were served at the conclusion of the meeting and music was furnished by the school jazz band.

Visit of the General Secretary

Seven members of the executive committee of the Hamilton Branch met at luncheon at the Wentworth Arms on April 14th, 1927, to meet R. J. Durley, M.E.I.C., general secretary of The Institute, who was visiting Hamilton. Several matters of interest to The Institute at large, and to the Hamilton Branch in particular, were discussed during luncheon.

During the day Mr. Durley visited a number of the manufacturing plants in the city, under the guidance of various members of the Hamilton Branch.

Lethbridge Branch

Wm. Meldrum, A.M.E.I.C., Secretary-Treasurer.

Mine Timber Tests

On Saturday, March 5th, Professor R. S. L. Wilson, A.M.E.I.C., addressed the Lethbridge Branch on "Mine Timber Tests."

Every once in a while, Albertans hear of an organization known as The Scientific and Industrial Research Council of Alberta. Now and then a glimmer of light is thrown on its work. Its personnel, made up of the faculty of the university, work along silently. A problem is offered for solution. Some one professor makes it his particular hobby, takes it home with him, sleeps with it, eats with it, uses it for relaxation from his routine of teaching, and finally becomes so intimately acquainted with that particular problem that he knows all its whims and secrets. It is something like breaking a broncho or training an ant. Years later, after most people have forgotten it, he brings the problem into your parlour, tamed and docile. It is a problem no longer. It has become an economic fact, and ready to serve Mr. Average Citizen in reducing his working costs or increasing his comfort.

Take the lodgepole pine, or jackpine, for instance. Professor R. S. L. Wilson, A.M.E.I.C., of Alberta University, on Saturday night, in an address before the Lethbridge Branch, dissolved this common tree and analyzed its moisture content, its seasoning period, the effect of peeling, how it stood up in mining practice and explained its bending and crushing loads. Ever since 1921 the Research Council has been collecting data on forest resources, and Professor Wilson's task has been with mining timbers, and the lodgepole in particular.

Timbers were placed in a working mine. Some of the test pieces were peeled, others had the bark on, others were fully seasoned. They were left for varying periods of time, and then removed for laboratory test. An ingenious machine was constructed at the university to subject the timbers to bending and crushing loads and to ascertain rate of deflection.

As an instance of how painstaking these investigations are, the method of ascertaining moisture content is an illustration: a one-inch disk is cut from the boom or prop and weighed. Then it is dried in an oven at 100 degrees centigrade and weighed each day until the two last weights show less than one per cent variation from each other. This is the dry weight. The difference between this and the original weight is expressed as a percentage of the dry weight and called the moisture content.

Then there is the question of fungus growth,—what particular germ is present when a timber rots? Here enters the botanist, who works much as a physician would work on tissue, and at this point the professor mentioned discovering a puzzling type of rot or disease that so far has baffled the botanist. Professor Wilson never lets his hobby get far from him, and for some months he had on his desk a piece of wood. One day a powdery dust appeared, and, when brushed off, reappeared day after day. The wood was slowly dissolving into dust. What caused it? What was the preventative? No one knows, but some day someone will find out. Of such intangible things does scientific research thrive on.

The professor's investigations are not complete. It may be two years yet before he may find what he requires. It may be that he will not find it in all its details. Results so far are encouraging. Mine timbers are costly in the aggregate. Anything that prolongs their life means money saved, may even mean greater security among those whose work takes them underground. Seven years is a long time to spend on one problem. To most people the subject would become monotonous, but to those who heard the professor Saturday night, there was no mistaking his enthusiasm. He will see it through, as others of this Research Council are seeing similar problems through.

Mining men were at the meeting, and the discussion which resulted showed how closely they had followed the address, which was illustrated with graphs and slides.

J. T. Watson, A.M.E.I.C., presided at the meeting, and there were about forty members and friends present. During the dinner that preceded the address, the Rainbow Orchestra supplied music and there were songs by Messrs. Meldrum and Fred. Rose. In fact, as is usual with these engineers' meetings, the musical entertainment was of a high order.

Annual Meeting

The annual meeting of the Lethbridge Branch was held on Saturday, March 19th, and the following were elected as members of the Executive Committee:—

G. S. Brown, A.M.E.I.C...............*Chairman.*
Nat. Marshall, M.E.I.C...............*Vice-Chairman.*
Wm. Meldrum, A.M.E.I.C.............*Secretary-Treasurer.*
N. H. Bradley, A.M.E.I.C.............*H.Q. Council.*
C. S. Clendening, A.M.E.I.C............
J. B. deHart, M.E.I.C.................
P. M. Sauder, M.E.I.C.................
J. T. Watson, A.M.E.I.C................*Ex-officio.*
Robt. Livingstone, M.E.I.C............
C. S. Clendening, A.M.E.I.C........... *Auditors.*
W. L. McKenzie, A.M.E.I.C............

The meeting opened with one of the regular luncheons, during which the Rainbow Orchestra performed. After luncheon, community singing and solos by R. S. Lawrence, A.M.E.I.C., and Wm. Meldrum, A.M.E.I.C., were much appreciated. The financial statement and report of the retiring executive were read by Secretary-Treasurer N. H.

Bradly, A.M.E.I.C., and adopted. Some good discussion on branch affairs was indulged in by many present. The meeting was well attended and received the announcement of the results of the election with hearty applause. The retiring chairman gave thanks where thanks was due, to the Entertainment Committee, Programme Committee and the Publicity Committee. His statements were heartily endorsed by the other members present. The new chairman, G. S. Brown, A.M.E.I.C., accepted his responsibilities in a nicely worded speech.

London Branch

F. C. Ball, A.M.E.I.C., Secretary-Treasurer.

Meeting of March 30th

A moving picture exhibition of the capabilities of caterpillar tractors for use in engineering works was given before the London Branch at the city engineer's office, Princess avenue school, on Wednesday evening, March 30th, 1927.

The lecture was given by Mr. Mackie, representing the firm of Best and Holt Caterpillar Tractor Company, at Toronto. The use of these machines for road grading, ditching and excavating large quantities of earth was clearly shown, together with the ease with which they are manipulated. A number of views of snow handling and general haulage of earth, stone, etc., up to twenty cubic yards at a time were shown, demonstrating the great saving of time and labour by the use of these tractors.

A general discussion followed on several practical phases of the use of these machines and on their life and cost. An interesting comparison was made between the cost of operating a tractor per day and the cost of a team and rig, which showed that while the cost of operating the tractor might be slightly higher the work would be done in a fraction of the time required by the team.

About thirty members and guests were present, amongst them being several local contractors. In conclusion, a vote of thanks to Mr. Mackie was proposed by the chairman, J. R. Rostron, A.M.E.I.C., and seconded by Charles Talbot, A.M.E.I.C., county engineer, and was unanimously carried.

Operation and Construction of B. & W. Type Water Tube Boilers

On Monday, April 11th, 1927, a lecture, illustrated by moving pictures, on the "Operation and Construction of B. & W. Type Water Tube Boilers," was given at the London Technical School. The speaker was J. O. Twinberrow, A.M.E.I.C., of Babcock-Wilcox and Goldie-McCulloch, Limited.

The lecture was specially interesting to those engaged in work of the nature and a number of members of the London Branch availed themselves of the opportunity to attend.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

Gunnery in the Great War

"Gunnery in the Great War" was the subject of an address given before the branch on March 29th by Professor John Stephens, M.E.I.C., of the University of New Brunswick. The meeting was held in the city hall and was open to the public, many members of military units being in attendance.

Professor Stephens, who was formerly an artillery instructor in England, opened his address with an historical outline of the development of artillery from the earliest times up to the present. The various problems entering into the theory of the science of gunnery were discussed, and the difficulties encountered in putting these theories into practice explained. In the opinion of the speaker, gun laying was now, as in olden times, to a great extent a matter of trial and error.

At the conclusion of the address one hundred slides, taken from photos of the official Canadian war records, were shown. Scenes taken on the various fronts, showing ammunition dumps, guns, towns in France and Belgium, were readily recognized by returned men present and brought back memories of the great war where many Moncton boys remain in foreign lands, having made the supreme sacrifice.

After the public meeting a short session of the branch was held, at which, on motion of A. F. Stewart, M.E.I.C., seconded by F. O. Condon, M.E.I.C., a resolution of sympathy was extended to the family of Mr. Hugh Jardine, a former member of the branch, whose death occurred recently.

Our Maritime Harbours

The regular monthly supper meeting was held in the Palm room of the Brunswick hotel on April 8th. G. C. Torrens, A.M.E.I.C., vice-chairman of the branch, presided, and during the supper hour referred to the time of meeting coming within a few hours of the tenth anniversary of the taking of Vimy ridge by the Canadians. The members were requested to rise and observe a one-minute silence in honour of those who had fought and would never return.

During the evening vocal solos were rendered by Mr. F. S. Wilkins, and trumpet selections by Mr. Fred. Cosman.

The vice-chairman then introduced the speaker of the evening, Mr. Thos. J. Locke, district engineer, Department of Public Works, Halifax, who delivered a very interesting address on "Our Maritime Harbours, Their Treatment and What They Mean to Us."

There is no other territory of similar size that possesses as extensive a coast line with as many bays, coves, harbours and shelters as the maritime provinces, with its 4.000 miles of coast line, upon whose inlets the Department of Public Works has placed nearly 1,000 coastal improvements. A harbour is a sheltered area which can be safely and surely navigated by shipping. Because a harbour is sheltered, however, does not relieve us from its improvement. A natural harbour is a haven of refuge for shipping, but shipping cannot ply the seven seas unless facilities for loading, discharging and repairing ships are provided.

Mr. Locke mentioned the various types of wharves, their construction and the different kinds of material used. Starting from the shore, they generally commence with a rock bank approach which is continued as far as the economical factor will permit. The character of the remainder of the wharf depends entirely on the nature of the bottom. If the material is penetrable a structure resting upon pile trestle bents is much to be preferred on account of low first cost and cost of repairs. The bracing of trestle work is somewhat changed. Instead of the old "V" or "X" bracing, which thirty years ago was universal, brace piles are used, and in all cases where heavy traffic does not exist no additional bracing has been found necessary. Where the bottom is not penetrable a cribwork form of construction is adopted. This is generally of the alternate block and span type.

In many of our coastal waters it is necessary to combat marine pests which attack the wooden members of the structures. Up to the present, the use of creosoted timber has been found to be the only real protection against these pests. Sixteen-pound treatment is specified with the additional proviso that the oil used in the treatment must contain not less than 40 per cent naphthalene. As an example of the necessity for a high percentage of naphthalene last fall a sample of creosoted log was obtained which had been submerged for twenty years. This sample was forwarded to the government analyst at Ottawa, who reported that practically all traces of creosote had, either through saturation or other causes, disappeared, except the naphthalene which had originally been present in the oil when the log was treated.

Breakwaters were mentioned by the speaker, who explained the different types required, according to location. Dredging was another matter touched upon and its importance stressed in making our harbours of more value.

At the conclusion of the address a hearty vote of thanks, moved by H. J. Crudge, A.M.E.I.C., and seconded by A. C. Selig, M.E.I.C., was tendered Mr. Locke for his address.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

Locomotive Feed Water Heating

A comparatively recent and successful development in the locomotive field was reviewed by Mr. W. C. Hamm, mechanical engineer for the Central Vermont Railway, in a paper on "Locomotive Feed Water Heating," presented to the branch on March 17th, 1927.

"The application of feed water heaters to locomotives in the United States, commencing in 1916 has increased until at present there are approximately 4,100 in service on this continent and several thousand in Europe.

"This was due," said the author, "to the increasing cost of locomotive fuel, the need for a more efficient locomotive and the size of the locomotives themselves, which makes the savings obtained show up quite handsomely."

Of the two-fold benefit obtainable through the application of the feed water heaters to locomotives, the first and generally more important benefit accrues from fuel saving, and the second, though equally or more important on low gradient lines, is the possible increase in boiler capacity resulting in an increased gross ton hour figure.

As only about 7 per cent of the fuel value is realized at the drawbar, a notable economy will be effected by any device that is capable of utilizing any portion of the approximately 25 per cent lost with the hot gases or the 58 per cent escaping with the exhaust steam. It is in this latter division that we have available a source of power which, if reclaimed, will result in substantial savings.

More than sufficient heat is available in the steam exhausted to preheat the feed water to within an average of ten degrees of the temperature of the exhaust steam. This then is an appreciable and direct saving in the use of fuel.

Offsetting this saving is the live steam consumption of the feed water pump and on an old locomotive, a loss in initial superheat, but these are largely compensated for by the increased evaporating efficiency of the boiler obtained by the lower fuel rate required, which, in turn, renders possible a reduction in the cylinder back pressure.

Another feature of the feed water heater which is often important is the return of the distillate from the exhaust steam to the boiler. This distillate, approximating 10 per cent of the feed water requirements, is distilled water, thereby eliminating immediately a corresponding per cent of the impurities carried in to the boiler besides obviating, in many cases, a water stop with its attendant delays.

The speaker proceeded to give very interesting service data from some fifty feed water heaters of both the closed and open types, operated in freight and passenger locomotives. These were all fully illustrated. Following this, a set of excellent lantern slides described in detail the four principal types of heaters that are being developed on American railroads. In the closed type there were the Elesco and the Coffin, and in the open type the Worthington and the Debig.

A discussion, led by Mr. E. A. Averill of the Superheater Company, followed by Messrs. R. S. Griffiths, John Roberts, E. Sauny and J. D. Alder, M.E.I.C., brought out the fact that it was possible some 14 per cent of the feed water was reclaimable, as the distillate, up to 30 per cent of the heat from the exhaust steam recoverable, and the boiler efficiency possibly increased by some 4 per cent.

The fuel saved on a $2,500 installation amounted to $1,650 a year, or a 65 per cent net return.

C. K. McLeod, A.M.E.I.C., in fitting terms expressed the appreciation of the meeting, which was presided over by J. S. Hall, A.M.E.I.C.

Geological Features of the District of Montreal

On March 24th, 1927, A. Mailhot, B.Sc., professor of geology at Ecole Polytechnique, presented to the branch an historical and descriptive narrative depicting the formation of the island of Montreal from earliest times.

The district of Montreal, affirmed the speaker, had once been covered at a remote epoch by a sea which remained sufficiently long to permit the deposition of many hundred feet of sediments. These sediments in time had been consolidated to form what is now the rocky substratum of the island.

These rocks constitute bands very nearly parallel to the Laurentian border, somewhat after the manner of a deck of cards; the first card, some 400 to 1,000 feet thick, would represent the Potsdam sandstone; the next, 1,065 feet thick, the Beckmanstown sandstone; the third, 785 feet thick, the Chazy limestone; the fourth, 695 feet thick, the Trenton limestone, and the fifth, 210 feet thick, the Utica shales.

After these Paleozoic formations were laid down the plain of the St. Lawrence in the vicinity of Montreal became the scene of great volcanic activity. Intrusions first of esseite and then of nepheline-syenite opened a passage through the limestone to form the igneous mass of Mount Royal over a surface of one and one-half square miles.

Following this era of volcanic activity, a great glacier covered the North American continent during the Pleistocene period. On its retreat, moraines of boulder clay were left on the solid rock beneath it, which, with the exception of the hard outcrops of Mount Royal, cover almost the whole of the island.

When the glaciers retreated to the north, the Atlantic ocean again entered the relatively depressed lower St. Lawrence valley to deposit the leda or bluish gray clay and the saxicava sands which cover the boulder clay in large areas on the island.

Though the sand and gravel will generally provide dry cellars, this cannot be said of the boulder and leda clays, which absolutely require the installation of a good drainage system under the foundations.

The speaker concluded his address by delineating the districts in which the solid rock approached the surface, a desirable feature for the erection of large factories, office buildings and departmental stores requiring a firm and solid foundation.

J. L. Busfield, M.E.I.C., expressed the appreciation of the meeting, which was presided over by A. Plamondon, A.M.E.I.C.

The Theory of Telephony Made Visible

Six reels of films, as certainly displaying the evidences of genius as does the marvellous art of telephony which they illustrated, were exhibited to the branch on April 7th, 1927, through the courtesy of the Bell Telephone Company of Canada and Mr. L. St. J. Haskell, assistant to the vice-president.

The first reel, entitled "Over Half a Century of Telephone Progress," showed the telephone pixy springing from the mouthpiece of a telephone desk set to disclose the secret of a long distance connection between San Francisco and Havana. By the aid of novel and fascinating illustrations she proceeded to explain the principles of loading and filter coils, carrier currents, phantom circuits, telephone repeater tubes and to describe the gradual progression from old time to present day equipment.

The subsequent reel illustrating the "Electrical Transmission of Speech" showed an ingenious device by which a beam of light is reflected from a system of moving mirrors to depict the oscillation of a sound wave. Illustrations of simple and complex waves in this device, both with and without the use of a resonator, led to a detailed description of the present telephone transmitter and receiver.

"The Magic of Communication" described in the third and fourth reel, revealed in very clear and entertaining manner the operation of a vacuum tube when used as a telephone amplifying instrument. Filaments, grids and plates lost their power to puzzle in the light of this splendid film.

The final reels presented "A Circuit Study of a Telephone Call," in eight steps. The intricate connections ensuing from the instant the subscriber raised his receiver from its hook until the operator finally disconnected the lines on the conclusion of the call, were taken up in logical sequence.

The well attended meeting, presided over by C. M. McKergow, M.E.I.C., concluded with motions of appreciation and thanks to the Bell Telephone Company by Howard T. Barnes, D.Sc., M.E.I.C., and H. S. Van Scoyoc, M.E.I.C.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

Northern Canada

An evening meeting of the Ottawa Branch, to which the public was invited, was held at the Chateau Laurier on March 24th for the purpose of hearing G. H. Blanchet, A.M.E.I.C., and Major L. T. Burwash, B.A.Sc., M.E., lecture on northern Canada. Both these gentlemen, who are fellows of the Royal Geographical Society, have travelled widely in the far north.

The addresses were profusely illustrated with many excellent lantern slides through the use of which the lecturers were able to convey to the audience some clear impressions of the character of the country, its people and resources, in the area from Lake Athabaska to the Arctic coast.

The chairman of the Ottawa Branch, Noulan Cauchon, A.M.E.I.C., presided, and first called on Mr. Blanchet, who spoke of his explorations of the past several years in the country surrounding Great Slave lake and extending to the sources of the Thelon and Coppermine rivers. He described the country in its relation to the base level of Great Slave lake and how it rises away from the lake to a great interior plateau which is the source of rivers draining to Hudson bay, Great Slave lake and the Arctic ocean. The first part of the journey in ascending from the Great Slave lake invariably led through hilly and rocky wooded country very similar to the Laurentians. Eventually one reached the great open spaces of the northern plains, and Mr. Blanchet described at some length the gradual thinning out of the woods, and the struggle for existence of the trees at the last line of the forest, where the trees which succeeded in growing in spite of the Arctic blasts, were very much dwarfed. He showed that the country beyond on the plateau was not barren, but grew considerable grass and moss, the food of the caribou and musk ox. His slides conveyed definite notions of the water powers, forest resources, game, fish, the Indian population, and methods of travelling and camping in the north.

Major Burwash followed Mr. Blanchet with a description of a trip he had made from the mouth of the Mackenzie river along the Arctic coast to Hudson bay. Mr. Burwash spoke particularly of the Eskimo settlements and trading posts along the way, and had numerous very fine slides of these people which were excellent character studies. He spoke of their primitive life in living off the game and fish of the country, and their trade in furs. Major Burwash travelled by steamer and schooner as far as Coronation gulf and afterwards continued his trip with sled and dog-team, eventually coming out at Hudson bay after traversing the greater part of the Arctic coast of Canada.

Commercial Aviation in Canada

Ellwood Wilson, M.E.I.C., president of the Fairchild Aerial Surveys Company of Canada, was the guest and speaker at a luncheon of the Ottawa Branch held on March 31st at the Chateau Laurier. He chose as his topic "Commercial Aviation in Canada." The speaker was introduced by Noulan Cauchon, A.M.E.I.C., chairman of the Ottawa Branch, who alluded to the presence of Albert R. Decary, D.A.Sc., M.E.I.C., President of The Engineering Institute of Canada, Hon. Chas. Stewart, Minister of the Interior, and G. J. Desbarats, M.E.I.C., Deputy Minister of National Defence. Mr. Cauchon eulogized the efforts of the last two named in connection with the development of aviation in Canada.

Mr. Wilson in introducing his subject drew a distinction between civil aviation and commercial aviation. The former, he said, was a government activity, distinct, to be sure, from military flying, but nevertheless paid for by the tax payers of Canada. Commercial aviation, on the other hand, was paid for by private enterprise and must earn a fair rate of interest. The Dominion Government, he said, had pioneered in aviation, and the costs of its experiments in the civil field should be made available for the study and benefit of commercial enterprise. He spoke of the work of the Government as really wonderful in blazing out the lines of effort and the maps of the Topographical Survey were models for everyone and would do a great deal to open up the country. This work of mapping, which had largely been confined to northern Ontario and certain sections of western Canada, should, he thought, be carried out in other sections of the Dominion.

Commercial aviation, Mr. Wilson said, is carried on in Canada by three companies in Quebec, two in Ontario and one in British Columbia. Canada and the United States, he said, were the only countries which have given no subsidies to aid commercial aviation, though they had given some encouragement in the way of contracts. He thought that the government's attitude towards commercial aviation should be clearly expressed within a reasonable time. Regarding air transportation, there were two courses open: either the government should definitely undertake it as a national enterprise like the Canadian National Railways, or it should definitely leave it to commercial companies. The government should say whether there is a field in Canada or not for commercial aviation.

So far in Canada, Mr. Wilson said, aerial activities have been directed towards the back country and have mostly consisted of aerial photography, fire patrol, transportation to equip survey parties and transportation to mining fields. His sphere had been mostly aerial photography, particularly as applied to forests. His original experiments in estimating timber from the air had been conducted in 1919, and now it was possible to make close estimates without going on the ground. The estimates of two ground parties on Anticosti island differed from the aerial estimates by not more than half a cord per acre. In Germany they were going so far as to give the size of trees from aerial photographs.

A great opportunity in the transport by air of mail and other matter is knocking at our doors, Mr. Wilson continued, and there is money and enterprise in Canada to start routes just as soon as traffic demands. He said that where there is a large volume of traffic warranting the use of large machines, air transportation can be performed at a rate to compare with the high class, extra-charge railroad trains. Flying is the perfect method of transportation, he said, and is the safest; the records show this fact, he maintained, and referred to the great and increasing number of automobile accidents. As for costs, he said that air mail contracts in the United States were placed at 0.22 cents per pound per mile, and that in England and other countries the cost was about the same. At present in Canada with small machines the cost could be estimated at $100 per hour, or one dollar per mile, but with an assured volume of traffic transportation could be made as reasonable as in other countries.

The use of airplanes, Mr. Wilson said, can play an increasing part in the development of the north in advance of the railroads. If aviation is not fostered the whole development will be delayed. He concluded his address with a plea for "airmindedness," and a realization of the advantages which are knocking at our doors.

At the conclusion of Mr. Wilson's address, which was enjoyed by a large attendance, Mr. Cauchon asked Mr. Decary to speak, and the President of The Institute expressed his pleasure at being present and hoped that the day would not be far distant when he could come to Ottawa for a luncheon and return to his office in time to carry out the afternoon's work.

Practical Notes on Oil Paints

An evening meeting of the Ottawa Branch was arranged for April 7th for the purpose of hearing a paper by A. K. Light, B.Sc. chemist of the Public Works Department, entitled "Some Practical Notes on Oil Paints and their Application." This paper is published on page 267 of this issue of the Journal.

Mr. Light has been connected with the testing laboratories of the Public Works for six years, during which time he has made a special study of paints for the purpose of determining the best types and methods of application to be used for various purposes. At this season of the year this subject is of special interest to all those who have to look after the preservation of structures, and there was a good attendance.

Mr. Light outlined the various qualities demanded of a good paint or varnish, the necessity for a high degree of opacity, great covering power, impermeability to moisture. No paint, however, will, he said, serve all purposes, and those which will serve well under dry conditions would be useless under moisture, or one intended for mural decoration would not last any time if used on a floor.

Mr. Light dealt with the various requirements of paints and their use, under the headings of pigments, vehicles, preparation of surfaces of wood, plaster, cement, brick and metals, the methods of applying the various coatings, the mixing of paints, the selection and care of brushes, and the economies of painting. He emphasized the folly of using cheap paint, and said that a little extra expenditure on the thorough preparation of the surface and for high quality paint carefully chosen for existing conditions, would be more than compensated for by the durability and long life of the resulting paint film.

Mr. Cauchon presided, and a feature of the evening was the presentation of a prize awarded by the Students' Prize Committee of The Institute to Henri A. Gauvin, S.E.I.C., of Ottawa, for a paper on "Scientific Principles and their Application to Dwelling House Construction."

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

Recent Progress in Electric Welding

At the regular meeting held on March 31st, 1927, R. E. Smythies, M.E.I.C., vice-president of the Lincoln Electric Company, Limited, Toronto, gave a paper on this subject, illustrated with a large number of lantern slides. This paper was previously presented before the Hamilton and Toronto branches, and is published on page 262 of this issue of the Journal.

The speaker mentioned that the art of electric welding began some forty years ago, but has only become a commercial proposition during the past eight years or so. A large number of typical examples of arc welding were shown on the screen and described by the speaker. In the case of steel tank and pipe work welding has almost entirely replaced riveting. An outstanding example is a water pipe for the city of Oakland, Cal., 5 feet 6 inches in diameter, 90 miles long, built up from 30-foot sections ⅝-inch thick. The longitudinal seams of these sections were welded in the shop on automatic seam welders and subjected to extremely rigid tests before acceptance. Other examples given were bronze turbine runners, manganese steel tramrails, fish plate joints, drilling jigs, etc.

Mr. Smythies stated that the actual cost of arc welding should be from one-half to one cent per pound of metal deposited. Amongst the advantages not usually mentioned in connection with arc welding is the saving in inventory and storage space required owing to the facility with which articles can be built up from standard material.

Mr. Smythies was an advocate of the heaviest welding current which the job will stand and stated that at present there is considerable variation between individual operators. He remarked that progress in the use of arc welding in structural steel work is relatively slow, apparently due to the difficulty of persuading structural engineers of the efficiency of arc welding.

The speaker was accorded a hearty vote of thanks for his interesting address.

Long Span Bridges

A meeting of the branch was held on April 14th, 1927, the speaker being Professor C. R. Young, M.E.I.C., professor of structural engineering, University of Toronto. His address on "Long Span Bridges" was given in characteristically lucid and attractive style and was illustrated with many fine lantern slides of bridges all over the world.

Professor Young dealt with his subject under the various classes of bridges.

Stone. Many of the earliest bridges were built of stone, and a classical example is the remains of a bridge in Italy built in 1371 with a span of 250 feet. The limit to the construction of stone bridges was reached in about 1905 with the building of a bridge in Saxony with a single span of 295 feet.

Cast Iron. The next material resorted to was cast iron, owing to the comparative ease of producing parts to any design. Robert Stephenson designed a 450-foot span in cast iron for the Britannia bridge (Menai Straits), but this was not used, the final bridge being of the tubular type.

Suspension Bridges. A noteworthy example of this type is the Menai Straits bridge, built by Robert Telford in 1825 with a centre span of 580 feet. The problem of stiffening the suspension type bridge and preventing waving of the floor under load was solved by Mr. John A. Roebling, and later bridges of this type are quite satisfactory.

The suspension bridge at Niagara Falls, built in 1855, safely carried railway traffic for forty-two years before being replaced by the present bridge. The Brooklyn bridge, 1,595-foot span, and the Manhattan bridge over the East river, New York, 1,470-foot span, are noteworthy examples of the type. Most suspension bridges utilize parallel wire steel cables, as this material has the highest strength, namely, over 200,000 pounds per square inch ultimate. Some suspension bridges, however, have been constructed with I-bar cables, an early example being the Elizabeth bridge at Buda Pesth, span 951 feet.

Mention was made of two types of towers, namely, the hinged or pin supported type and the flexible type, the speaker expressing a personal preference for the former. The present high water mark of suspension bridge construction was stated to have been reached in the Delaware river bridge, in which the principle of loaded back stays gives a pleasing appearance. This bridge carries six lanes of traffic and is carried by two steel cables thirty inches in diameter.

At this point the speaker took occasion to describe the method of using pneumatic caissons.

Arch Type. Examples of this type mentioned were the Hell Gate bridge at New York and the Sydney bridge, Australia, now building, for a span of 1,650 feet.

Brief mention of the truss type and continuous girder type was made before passing to the cantilever type.

Cantilever Type. The classical example of the cantilever is the Forth bridge, with two spans of 1,710 feet each, but the design, using tubular compression members, would not be considered economical at the present time. Professor Young next described the Quebec bridges, giving the reasons for the first and second failures and a description of the final bridge.

Concrete Bridges. In giving examples of this construction, the speaker expressed great admiration for the advanced work done by French engineers with this material. A good example on this continent is the 400-foot concrete span at Minneapolis.

Projected Bridges. The speaker mentioned two very long span bridges now projected, and which seem to have a fair possibility of being proceeded with, namely, Hudson river bridge, 3,500 feet, and the Golden Gate bridge, San Francisco, about 4,000 feet.

A vote of thanks to Professor Young was proposed by R. L. Dobbin, M.E.I.C., and heartily approved.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

Town Planning in Saint John

The Saint John Branch of The Engineering Institute of Canada assisted in a worthwhile community effort recently when one of its meetings was devoted to the discussion of the subject of local town planning. Curiously enough, Saint John was one of the first cities on the American continent to consider the subject of modern town planning as a means of directing in an orderly and comprehensive manner the future growth of the city. It had a town planning commission in active consultation over a period of several years, and had a town planning map prepared covering the city proper and suburbs, but with town planning proposed for the present not applying to the built-up sections of the city and outskirts. Here the matter has rested for some four years until the Saint John Branch revived the subject as one of engineering as well as of general interest

The subject introduced by a paper entitled "Town Planning in Saint John," was delivered by Mr. W. F. Burditt in the Board of Trade rooms before the branch on the evening of March 31st, 1927. Mr. Burditt was a member of the Town Planning Commission of Saint John and is well informed on all phases of town planning. A. R. Crookshank, M.E.I.C., acted as chairman of the meeting.

The first section of the address dealt in a general way with the subject of town planning; the need of traffic arteries, zoning regulations, set-back restrictions on streets ear-marked for later widening; provision for parks and recreation areas, etc. Lantern slides were shown of different features of town planning applied in a number of cities throughout the world.

Tracing the history of the town planning movement in this province, the speaker mentioned that the Town Planning Act was passed in New Brunswick in 1912. This was merely a permissive act by which any local authority or town planning commission might apply to the government to have some scheme passed on before its adoption. In Saint John a town planning scheme was prepared largely under the guidance of Mr. Thomas Adams and his assistants on the Commission of Conservation.

As applied to Saint John it is proposed, under the town planning scheme, to lay out a system of skeleton roads on the outskirts of Saint John so that any later subdivisions may conform with the general scheme. It provides that such necessities as water and sewerage systems be built and roads graded over a small area before building lots be sold, to prevent scattered building over a large area with resulting high taxes. Certain roads which must eventually carry more traffic it is proposed to widen, and any later building along such roads cannot be built to the present side lines. Provision is made for certain desirable areas to be maintained as in open spaces and parks. All restrictions are reasonable and have been successfully applied in other places. A large town planning map of Saint John and environs was used for demonstration purposes.

A number of interested citizens, not members of the branch, were in attendance at the meeting. Dr. W. W. White, mayor of Saint John, was present and in a speech expressed his sympathy with the town planning movement and the benefits Saint John and surrounding district would derive from it.

The branch members were pleased to welcome to the meeting R. A. Ross, D.SC., M.E.I.C., of Montreal, a past president of The Institute. Mr. Ross was called upon for a few remarks.

A vote of thanks to Mr. Burditt was moved by Alex. Gray, M.E.I.C., and Geoffrey Stead, M.E.I.C., and extended to the speaker on behalf of those present by the chairman of the meeting.

Maritime Harbours

At a branch meeting on April 7th, 1927, the members were addressed by Thomas J. Locke, district engineer of the Department of Public Works, Canada, Halifax, N.S., on the subject of "Maritime Harbours, How Treated and What They Mean to Us." A. R. Crookshank, M.E.I.C., presided as chairman of the meeting.

The speaker discussed the extensive coast line of the Maritime provinces and described the work done by the Dominion government in affording means for the protection and development of the fishery harbours and facilities for general shipping.

The development of harbours naturally included sites where there was natural protection as well as sites on barren, exposed coasts where all protection works had to be provided; the latter being usually handy to a good fishing ground. The works constructed on the exposed Sable island, lying in the Atlantic south of Nova Scotia, were mentioned as a good example.

Harbour protection works were vital to many isolated fishing communities. The speaker cited the case of works built in 1901 at a cost of $19,000, in a locality where, for want of previous protection, only seven fishing boats had remained in service and the catch did not exceed $500 per boat annually. By 1911, forty fishing boats were engaged with a yearly income of $900 each, while to-day sixty boats are in commission at this place and the yearly catch is $1,500 per boat. Without harbour protection works at this place the entire district would probably have been depopulated by this time.

The speaker mentioned various types of crib and pile wharves, and also the use of rock-fill construction at suitable localities. The damage to timber structures from teredo and limnoria was also described as being extensive within these waters.

A lively discussion was engaged in by many of those present, and many questions were answered by Mr. Locke, and it was evident once more that an intelligent discussion on a paper is a means of bringing out much valuable additional information.

A vote of thanks was extended to Mr. Locke on the motion of Geoffrey Stead, M.E.I.C., and Alex. Gray, M.E.I.C. W. C. Risley, M.E.I.C., councillor of the Sydney Branch, was welcomed to the meeting.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary.

Visit to Carbide Company's Plant

On Friday, April 1st, 1927, at 6.45 p.m., thirty-seven members met at the dock of the International Transit Company. Owing to the ferry being out of order, Mr. Pickering, the manager, had kindly arranged to have a launch there which took the members across the St. Mary's river to the Union Carbide Company's dock on the Michigan side. Awaiting on the dock to greet the party from Sault, Canada were Mr. Boult, works engineer, Mr. Baker, assistant superintendent, and Mr. Brown, all of the Union Carbide Company of Sault Ste. Marie, Michigan.

Mr. Boult took the party through the spacious and well-equipped offices, arriving at the draughting room, where the following members of the Carbide staff, Messrs. Griffin, Hansen, Comb, McGovern and Thomas, were waiting to add their welcome to the visitors from across the river. From the draughting room, Mr. Boult led the party upstairs to a large and fully-equipped dining room which is for the use of the employees of the company. There, as guests of the Carbide Company, the entire party of visitors and members of the staff thoroughly enjoyed themselves, judging by the numerous times that those serving were called upon to pass and refill the platters with well-cooked lake trout, vegetables, etc. Mr. Boult called it a luncheon, and everyone wondered what a dinner served there would be like.

Geo. Kohl, A.M.E.I.C., as chairman of the Sault Ste. Marie Branch, expressed his thanks and appreciation and also, on behalf of the members, he thanked Mr. Boult and fellow-employees of the Carbide Company for the royal manner in which they entertained the members. He outlined the growth of The Institute since it was organized in 1887, and extended an invitation to the Carbide Company employees and also to all engineers in the Michigan Sault to come over and attend the meetings which are held on the last Friday of each month.

J. Hayes Jenkinson, A.M.E.I.C., seconded Mr. Kohl's remarks, and expressed his appreciation of the company's hospitality.

Mr. Boult expressed his pleasure in having and in being able to entertain the Canadian engineers at this luncheon. He said that this visit had been talked about for some time, and at last realized, and the only thing that he was sorry about was that Mr. White, the superintendent of the company, was unable to be present, but that he had sent his regrets.

Mr. Baker also expressed his pleasure in having the members from Sault, Canada, visit the plant.

Mr. Boult called upon Mr. W. E. Comb, who read an article written by H. L. Moyes, chief engineer, Union Carbide Company, in the Engineering News Record of October 2nd, 1924. This article gave a complete and most comprehensive description of the lime-burning plant and its operation at the plant in Sault Ste. Marie, Mich.

Mr. Boult read another article from the Acetylene Journal, June 1926, on the "Construction of Kilns" as used in their lime-burning plant and also on the various tests that have been made in the kilns since having been put into operation. It gave a comparison of the riveted and welded kilns. These tests showed that the welded kiln could be put in at less cost and also that, after having been in use for some time, it remained the truest and in much better condition.

The visitors were divided into parties of four and five and, under the guidance of the members of the staff, an inspection was made of the calcining plant. The coal pulverizing plant was most interesting. The lime-burning kilns were visited, and the manufacture of lime from crushed limestone in the rotary kilns was a very interesting operation. The capacity of the plant is 300 tons of lime per day.

After leaving the lime-burning plant, the party visited the recreation building. This is a fine red brick building, well equipped, for the use of the employees of the company. The first floor has a splendid gymnasium, kitchen and reading room. The second has card rooms and a large lounge or sitting room. The basement is finished and has bowling alleys and pool tables in the main part, and under the front entrance is situated the wash and cloak rooms. As there was nearly an hour to wait for the launch, the members amused themselves in various ways, and the exhibition of bowling by some of the members was well worth watching.

The executive and members wish to express their appreciation to the management and to those of the staff of the Union Carbide Company for their hospitality.

Toronto Branch

W. B. Dunbar, A.M.E.I.C., Secretary-Treasurer.
J. Hyslop, M.E.I.C., Branch News Editor.

Annual Meeting

The annual meeting of the Toronto Branch was held on Thursday evening, March 24th, in room 22 of the Mining building, University of Toronto, about thirty members being present.

Owing to the illness of J. G. R. Wainwright, A.M.E.I.C., the chair was taken by R. B. Young, M.E.I.C., vice-chairman.

The secretary read the notice to members calling the annual meeting, following which the minutes of the annual meeting held on March 25th, 1926, were read and confirmed.

Owing to the absence of the chairman, there was no regular chairman's address, but the vice-chairman gave an informal talk referring to the executive's policy regarding meetings and finances during the past year.

The following acted as scrutineers in connection with the election of officers for the coming year:—

George McCarthy, M.E.I.C.
J. J. Traill, M.E.I.C.
A. V. DeLaporte, M.E.I.C.
F. B. Goedike, A.M.E.I.C.
E. C. Higgins, Jr.E.I.C.

The secretary-treasurer presented his report and financial statement, which was examined by the auditors, and, after some discussion, was adopted by the meeting.

Reports were presented by the chairmen of the following sub-committees, which, after discussion, were adopted by the meeting and any suggestions contained in the reports referred to the incoming executive:—

Programme Committee ....J. G. R. Wainwright, A.M.E.I.C.
Finance " ....R. B. Young, M.E.I.C.
Publicity " ....James Hyslop, M.E.I.C.
Attendance Committee ....L. W. Wynne-Roberts, A.M.E.I.C.
Library " ....A. T. C. McMaster, M.E.I.C.
Student Relations ....W. B. Dunbar, A.M.E.I.C.
Membership " ....E. T. J. Brandon, A.M.E.I.C.

Considerable interest was shown in these reports, as they indicated the excellent work done by the committees in promoting the interests of the branch.

The report of the Finance Committee showed that the expenditures had been within the revenue and that the branch had entered the new year without any outstanding debts. The committee recommended that the system of budgeting be adopted for the forthcoming year.

In discussing the report of the Student Relations Committee, a number of valuable suggestions were made by various speakers. There ensued a lengthy discussion on branch affairs, with particular reference to meetings, membership, methods of promoting discussion and the general objects of The Institute. It was decided that the branch should continue the policy of holding two regular meetings each month.

The report of the scrutineers was then presented showing the following officers elected for the year 1927-28:—

Chairman ....R. B. Young, M.E.I.C.
Vice-Chairman ....J. A. Knight, A.M.E.I.C.
Secretary-Treasurer ....W. B. Dunbar, A.M.E.I.C.
Committeemen (2 years) ...C. S. L. Hertzberg, M.E.I.C.
J. J. Traill, M.E.I.C.
Thomas Taylor, M.E.I.C.

The newly-elected officers were then installed, following which Mr. Young thanked the executive and members on behalf of the retiring chairman for their support during the past year and asked for continuance of this support during his term of office. The newly-elected officers then thanked the members for the honour conferred upon them, after which a hearty vote of thanks was moved to the retiring chairman, secretary and members of the executive.

Vancouver Branch

F. P. V. Cowley, A.M.E.I.C., Secretary-Treasurer.

The Reading and Writing of an Engineer

A regular meeting of the branch was held on March 16th when an instructive address on "The Reading and Writing of an Engineer," was delivered by J. Porter, Esq., B.E.

The speaker showed the futility of reading technical books only, advised engineers to allot but brief time to the reading of the daily press, and suggested a broad field of general reading. In writing, Mr. Porter stressed the dangers of ambiguity, self-advertising, and public controversy, and pleaded for more lucid reports for public bodies, and for those not technically highly educated. The speaker urged a more active interest in community affairs, especially on the part of younger engineers.

Meeting of March 23rd

J. M. Begg, A.M.E.I.C., the chief engineer of the Vancouver and Districts Joint Sewerage and Drainage Board spoke on the work of the Board, illustrating his remarks with a large wall map. Sketching briefly the work of the Board since its inception, he brought his hearers to a better realization of the difficulties which had been overcome. Mr. Begg outlined the situation as at present existing, and showed how a continuous growth of the whole community was being provided for. The area served by the board included the city of Vancouver, and the municipalities of Point Grey, South Vancouver and Burnaby. The paper was followed by a lively discussion, many members taking part, the attendance establishing a record for the month of March.

The Engineering Profession and Its Relation to Engineering Education

At the meeting of the branch, held on April 6th, the fifth paper of the series on engineering education entitled "The Engineering Profession and Its Relation to Engineering Education," was read by E. A. Wheatley, A.M.E.I.C. Mr. Wheatley told of the co-operation between the Association of Professional Engineers of British Columbia and the University of British Columbia, which he, as registrar, had been striving to advance for five years. Progress had been made, but much was yet to be accomplished, and he looked for the time when the engineering profession would be more adequately represented on the council of the university.

Canadian Ingersoll-Rand Company, Limited, have announced that they have moved their executive offices from 260 St. James Street, Montreal, to 10 Phillips Square, Montreal, Que.

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Preliminary Notice

of Applications for Admission and for Transfer

April 16th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in May 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BOSSU—FRANCOIS, of Montreal, Que., Born at Loos-en-Gohelle, France, Dec. 12th, 1898; Educ., C.E., Univ. of Montreal, 1924; 1920 (summer), mechanical drawing, Northern Electric Co.; 1921 (summer), Dept. of Rys. and Canals, asst. engr.; 1922-27, Quebec Streams Commission, asst. engr.; April 1926 to Jan. 1927, on constrn. of Int. Paper Co.'s Bitobee dam; 1927 to date, civil engineer with City of Montreal.

References: H. A. Terreault, G. R. MacLeod, O. O. Lefebvre, A. Duperron, H. Massue, L. A. Dubreuil.

BRODSKY—GREGORY, of London, Ont., Born at Kiev, Russia, Jan. 17th, 1882; Educ., equivalent to M.A., Kiev University, 1907; research student in physics, Cambridge, 1906-07; 1902-03, study in mech'l engrg. at Darmstadt, Germany; 1899-1902, practical work in beet sugar making, brewing and mechanical shops; engaged in independent scientific research and development of own inventions; advisor to Govt. depts. in England on optical signalling apparatus, studying agriculture and other sciences, until the war; 1915-16, deputy asst. inspector of aeroplanes; 1917-19, deputy asst. commission to Baltic States; in Canada since 1921; taught maths. and languages at Pictou Academy, 1923-24; physics at Univ. of Western Ont., 1924-25; for past year developed own inventions; was in the service from August 1914 to May 1920, demobilized as captain.

References: J. R. Rostron, W. P. Near, E. V. Buchanan, W. M. Veitch, F. C. Ball.

GORMAN—JOHN J., of Grand Falls, N.B., Born at St. John, N.B., Nov. 12th, 1896; Educ., B.Sc., Univ. of N.B., 1924; with N.B. E.P.C.—1922 (summer), rodman and instrumentman on transmission lines; 1922 (fall), 2 mos. i/c constrn. of storage dam at Seven Mile Lake; 1923 (summer), concrete inspector on Musquash reconstruction; May to Oct. 1924, i/c transit party on storage survey of St. Francis River; Oct. to Jan. 1925, in office of St. John working on storage plans; Jan. to March, i/c transit party on storage work at Temiscouata Lake; March to Sept., office work at Grand Falls; Oct. 1925 to July 1926, salesman for Miami Supply Co., Miami, Fla.; Aug. 1st, 1926, to date, field engr. i/c construction of main dam and tunnel intake for St. John River Power Co., Grand Falls, N.B.

References: A. C. D. Blanchard, G. H. Lowry, S. R. Weston, T. C. McCarthy, E. O. Turner, J. Stephens.

HERMANN—GEORGE ELLIOTT, of N. Vancouver, B.C., Born at Philadelphia, Penn., Oct. 31st, 1886; 3 yrs. practical course in structural steel fabrication with Am. Bridge Co. at Ambridge, Penn.; 4 yrs. until 1911 inspector for R. W. Hunt & Co. in Pittsburgh, on bridges, bldgs. and steel structures; 1911-16, mgr. of Pacific N.W. district, inc. B.C. and states of Washington and Oregon, for R. W. Hunt & Co.; 1916 to date, managing director, Vancouver Creosoting Co. Ltd.

References: W. G. Swan, G. F. Stirrett, H. Rindal, G. A. Walkem, T. A. McElhanney.

KINGSMILL—CHARLES GRANGE, of Ottawa, Ont., Born at Toronto, March 25th, 1903; Educ., B.A.Sc., Univ. of Toronto, 1924; 1918-21, Royal Naval Coll. of Canada; 1922 (summer), Manitoba Power Co., Great Falls, Man.; 1924-25, Quebec Development Co. at Isle Maligne, laying out and supervising constrn., including excavation, reinforced concrete and structural steel; 1925-26, with Aluminum Co. of Canada at Arvida, Que., on same work.

References: C. E. Legris, F. H. Cochran, R. W. Angus, H. R. Wake, P. Gillespie, W. S. Lee, C. P. Disney.

NICOLLS—JASPER HENRY HUME, of Ottawa, Ont., Born at Quebec, Que., Feb. 7th, 1886; Educ., B.Sc., McGill Univ., 1908; M.Sc., McGill Univ., 1912; 1908-09, asst. chemist, Govt. coal tests, McGill University; Oct. to Dec. 1909, asst. chemist, J. S. Donald & Co., Montreal; Jan. to July, 1910, asst. chemist, Northern Explosives Ltd., Rigaud; 1910-11, demonstrator in chemistry, McGill Univ.; Feb. to Mch. 1912, asst. chemist, coke ovens lab., Dominion Iron & Steel Co., Sidney; 1912-14, asst. chemist and chemist, Canada Cement Co. Ltd., at Montreal, Winnipeg, Exshaw and Calgary; Nov. 1914 to date, as asst. chemist and for last five years as research chemist and supervisor of routine laboratory, Fuel Testing Labs., Dept. of Mines, Ottawa.

References: C. Camsell, J. McLeish, B. F. Haanel, R. E. Gilmore, A. Ferguson, H. T. Barnes, E. Stansfield, C. K. McLeod.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

BLAIR—DAVID EDWARD, of Montreal, Que., Born at Montmagny, Que., July 25th, 1877; Educ., B.Sc., McGill Univ., 1897; 1897-03, electrical and mech'l engr. on constrn. and operation, Quebec Street Railway Co.; 1903-25, supt. of rolling stock, Montreal Tramways Co., i/c all elect'l and mechanical engineering work as well as full executive responsibility; Jan. 1925 to date, general supt., Montreal Tramways Company.

References: K. B. Thornton, G. R. McLeod, J. H. Hunter, R. M. Hannaford, P. S. Gregory.

MONKMAN—GEORGE HUMPHREY NELSON, of Bromhead, Sask., Born at Winnipeg, Oct. 22nd, 1888; Educ., collegiate and private tuition in maths. and mechanics; 1904-09, chainman, rodman, topographer and instrumentman on C.P.R. constrn. work; 1909-12, res. engr. i/c grading; 1912-14, res. engr. on bridge constrn.; 1915-18, overseas with C.E.F. as, surveying corporal for Can. Ry. Constrn. Corps, lieut. Corps of Royal Engr. and captain with same Corps; 1919-20, res. engr., C.P.R.; Nov. 1919-Mch. 1920, locating engr.; 1921-23, office engr., Dept. of Highways, Regina, Sask.; 1923-26, asst. engr. i/c constrn. Leader southeasterly branch and Pashley northeasterly branch for C.P.R., also i/c location of 120 miles railway in southern Sask.; Sept. 1926 to Mch. 1927, i/c constrn. of Bromhead westerly branch of C.P.R. and i/c railway location party in western Sask.; at present, asst. engr., C.P.R. engrg. dept., Winnipeg, Man.

References: W. A. James, C. Flint, V. Michie, J. R. C. Macredie, H. R. McKenzie, D. Hillman, C. L. Hervey, T. C. Macnabb.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

KEITH—WILLIAM HARGREAVE, of Islington, Ont., Born at Newmarket, Ont., March 28th, 1900; Educ., B.A.Sc., Univ. of Toronto, 1924; 1916-17-19 (summers), chainman, rodman, concrete inspector, etc., James Proctor & Redfern, Toronto; 1918, R.A.F.; 1920 (summer), i/c waterworks constrn. for James Proctor & Redfern in Acton, Ont.; 1921, i/c pavement and bridge constrn. for Toronto & York Roads Commission; 1922 (summer), cost accountant, etc., Warren Bituminous Paving Co. of Ont. at Toronto; 1923 (summer), i/c waterworks constrn. for James Proctor & Redfern; 1924 to date, asst. engr. i/c waterworks and pavements, design and constrn. and chief dftsman, Twp. of Etobicoke, Islington, Ont.

References: P. Gillespie, T. R. Loudon, E. M. Proctor, W. B. Redfern, R. O. Wynne-Roberts, C. R. Young, R. M. Smith.

McCUAIG—DONALD ALEXANDER, of Toronto, Ont., Born at Minto, Man., April 7th, 1897; Educ., B.Sc., Univ. of Man., 1923; Aug. to Dec. 1916, drainage survey; Jan. to May 1917, survey, Greater Wpg. water district; 1917-19, lieut., R.F.C.; 1922-23, records engr., Fraser Brace Constrn. Co., Great Falls, Man.; May to July 1923, electrician, Man. Power Co., Great Falls; July to Sept. 1923, dftsman, Duquesne Light Co., Pittsburgh, Penn.; 1923-26, designer and checker, hydro-electric and steam power stations, Stone & Webster, Inc., Boston, Mass.; 1926-27, asst. electrical engr. to ch. electrical engr. on design of power station for Susquehanna Power Co., Stone & Webster, Inc.; at present, i/c western office, at Winnipeg, of Ferranti Electric Limited.

References: J. B. D'Aeth, E. P. Fetherstonhaugh, N. M. Hall, J. N. Finlayson, A. B. Cooper.

FOR TRANSFER FROM AFFILIATE TO A HIGHER GRADE

EVANS—HUBERT GEORGE, of St. John, N.B., Born at London, Ont., July 15th, 1886; Educ., 1903-10, apptce. erecting and operating steam and gasoline engines, boilers, pumps, etc., and studying dfting and mech'l engrg.; 1910-15, dist. mgr. for E. Leonard & Sons Ltd. of London at Wpg., specializing in power plant equipment, i/c installations such as generating unit, electric generating plant, etc.; 1912, secured first class engineer's license for Saskatchewan; 1915-17, supt., McAvity shell plant, St. John; 1917-19, night supt., McAvity shell plant, where, in addition to regular duties, had charge of laying out machine tools, power transmission and work routine for two additional shops; 1921 to present, dist. mgr. for Can. Ingersoll-Rand Co. for N.B., specializing in engrg. sales work on compression rock drilling, centrifugal pumps, steam pumps and power plant equipment.

References: J. D. Garey, J. Stephens, G. H. Waring, E. G. Cameron, J. A. W. Waring.

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ENGINEERING JOURNAL

THE JOURNAL OF
THE ENGINEERING INSTITUTE
OF CANADA

JUNE, 1927

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Experimental Determination of Hydraulic Constants in a Large Aqueduct

A Series of Tests to Determine the Discharge of the Greater Winnipeg Water District Concrete Aqueduct by the Use of the Salt-Velocity Method

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Professor of Civil Engineering, University of Manitoba.

Paper read before the Winnipeg Branch of The Engineering Institute of Canada, March 3rd, 1927

In the autumn of 1925, a series of tests was conducted for the purpose of determining the discharge of the concrete aqueduct of the Greater Winnipeg Water District, which had been in continuous service for six years. This aqueduct, which is nearly one hundred miles long, is of the open flow type except at river crossings. A typical cross-section of the aqueduct is shown in figure No. 2. It was designed for a maximum carrying capacity of 85,000,000 imperial gallons per day, a value of 0.013 being used for the coefficient of roughness in Kutter's formula. At the time of the opening of the aqueduct, measurements of discharge were made, using the colorimetric method. The results, shown in figure No. 3, indicated that the new aqueduct could discharge twenty million gallons in excess of its estimated capacity, the value of the coefficient of roughness being well below 0.012. The objects in making the tests herein described were to check these measurements by other methods and incidentally ascertain the effect on the concrete of six years of service.

It is recognized that the colorimetric method has certain defects and limitations; the error arising from the personal equation is probably the most noteworthy. Moreover, it is not adaptable for gauging flows in water for domestic use. It was decided to use the salt-velocity method in making this series of tests, a method used successfully in measuring the flow of water through penstocks of hydraulic power plants, but not generally applied in gauging that in long water-supply conduits.

The sites chosen for the experiments were those used by the previous observers, namely, between manholes at miles 96.7, 95.7 and 94.7, near the intake in that length of aqueduct designated " S " section, and those at miles 86.6, 85.6 and 84.9, in the length known as " B " section. The slopes of the inverts were determined precisely, on the completion of the aqueduct, before the water was admitted, and are noted in table No. 1. The inside dimensions of the finished sections were also measured carefully, those of section " S " being shown in figure No. 3. The height of section " B " is 7 feet 4⅝ inches and its maximum width 8 feet 9 inches. Bench marks are established beside each manhole.

As the sites chosen were unsheltered and far removed from power lines, it was impossible to apply any of the refined measuring devices employed in penstock gauging. It was found by trial that fifteen handfuls of coarse salt dissolved in three gallons of water would form a brine sufficiently strong to cause an increase in electrical conductivity in the water in the aqueduct capable of giving adequate deflections in the ammeter connected to electrodes which were placed in the water at the manhole one mile farther downstream than the point of injection. The current applied to the circuit was obtained from two six-volt storage batteries as used in automobiles. A milli-voltmeter was used as an ammeter. The electrodes were strips twelve inches long by four inches wide cut from sheet iron roofing placed one and one-half inches apart. It is suggested that smaller electrodes made of insulated plates placed about one-half

Table No. 1.—Experimental Data and Constants Derived.

Section	Mile	Approx. flow M.G.D.	Depth	Area	Velocity	"Q" M.G.D.	Slope	Hydraulic Radius	$\sqrt{R}$	$\sqrt{S}$	Chezy's "C"	Kutter's "N"	Williams and Hazen's "C"
		30	2.539	19.4	2.952	30.9	0.0003	1.652	1.288	0.0172	132.1	0.0124	168.4
B	84.9	67	4.457	35.4	3.572	68.4	0.0003	2.175	1.479	0.0172	139.6	0.0123	169.5
		81	5.125	40.2	3.810	82.6	0.0003	2.250	1.502	0.0172	146.5	0.0117	176.7
		30	2.539	19.4	3.025	31.6	0.0003	1.652	1.288	0.0172	135.7	0.0124	172.6
B	85.6	67	4.458	35.4	3.611	69.0	0.0003	2.175	1.479	0.0172	141.0	0.0123	171.1
		81	5.184	40.6	3.740	82.2	0.0003	2.250	1.502	0.0172	143.8	0.0116	173.5
		30	3.430	33.4	1.783	32.2	0.00011	2.130	1.462	0.0105	116.7	0.0145	147.5
S	94.7	67	5.440	53.5	2.349	67.9	0.00011	2.650	1.629	0.0105	137.3	0.0128	167.9
		81	6.037	59.0	2.548	81.2	0.00011	2.775	1.668	0.0105	145.7	0.0120	176.5
		14	2.260	20.8	1.285	14.4	0.00011	1.507	1.230	0.0105	99.7	0.016	134.0
		30	3.453	33.5	1.812	32.8	0.00011	2.140	1.466	0.0105	118.0	0.014	149.4
S	95.7	67	5.620	55.2	2.294	68.2	0.00011	2.690	1.641	0.0105	133.1	0.013	162.3
		81	6.221	60.5	2.500	81.6	0.00011	2.790	1.671	0.0105	142.6	0.012	172.6

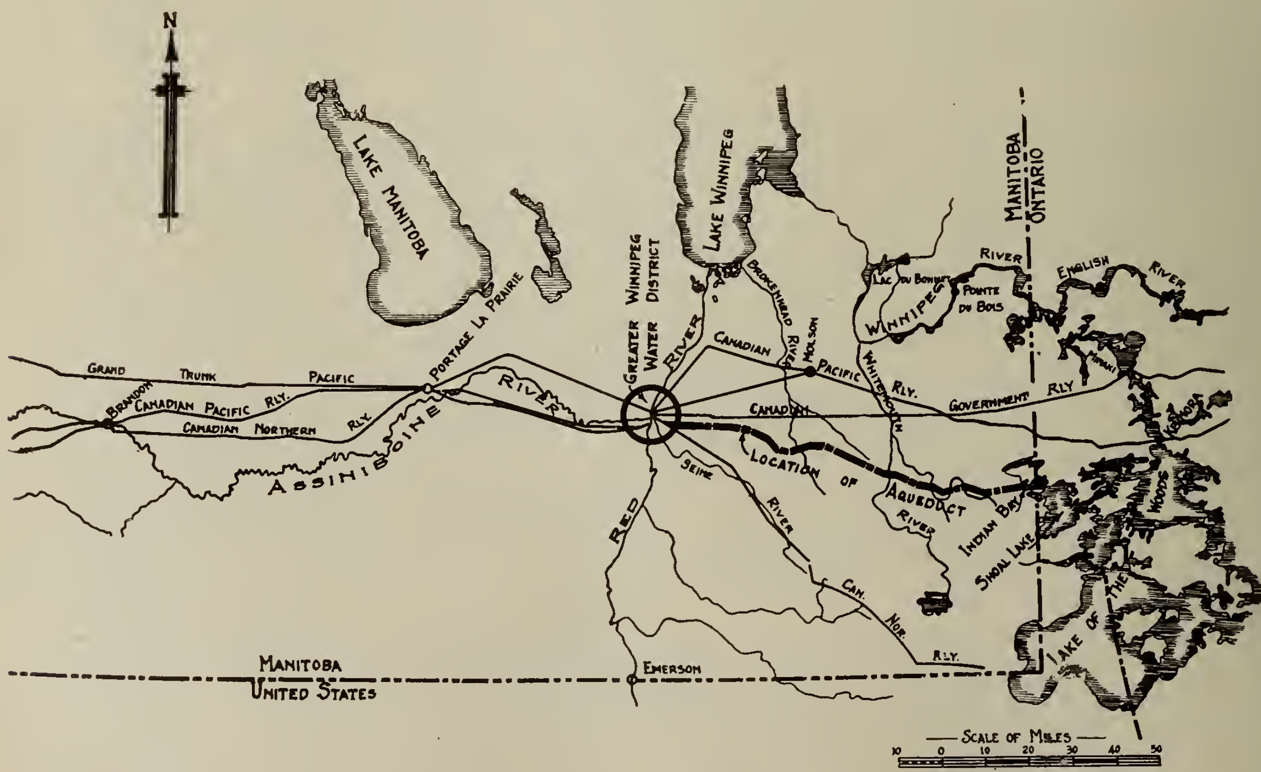

Figure No. 1.—Map showing Location of Aqueduct.

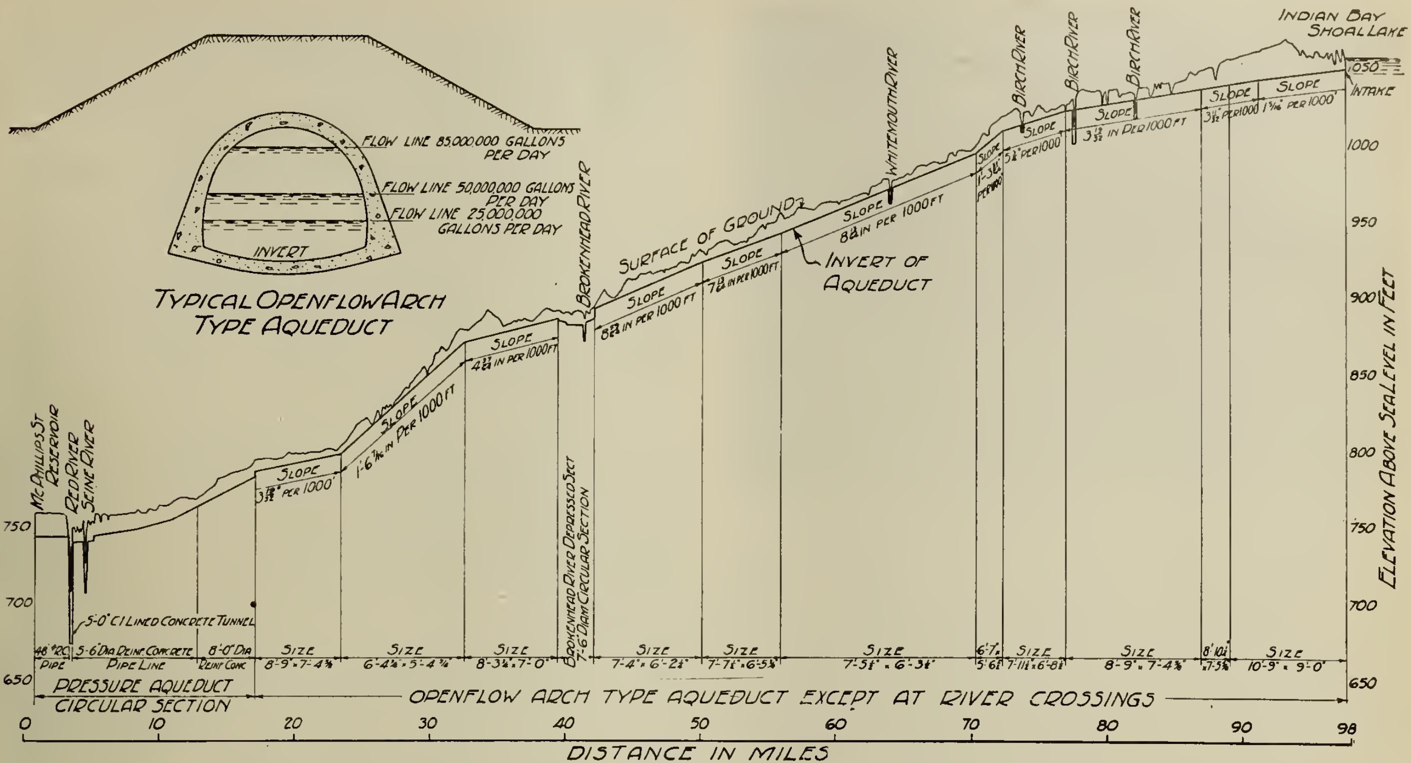

Figure No. 2.—Profile of Aqueduct with Cross-section of Openflow Arch Type Section.

inch apart might be used to advantage in making subsequent tests, these being more easily inserted, offering less resistance to the flow and giving more steady ammeter readings.

The elapsed times between the injection of the brine through the manhole and the indicated increases of the amperage as read in the ammeter were obtained from two pocket watches of good make, previously compared, which were sheltered in the hands of the observers during the periods of the tests. At first, stop watches were used which were found to give inaccurate results over long periods of time, the extent of the inaccuracy, as determined later, amounting to as much as 48 seconds in an interval of two hours, with indications pointing to varying rates of gain and loss.

The brine was lowered swiftly and carefully through the upstream manhole at prearranged times, and the times of its arrival at the electrodes one mile downstream with the corresponding amperages were noted carefully and listed by the recorders at that station. The amperages were afterwards plotted to time bases and the centres of area of these curves obtained. The time measured between a centre of area and the time of injection is the mean time, which, divided into the distance between manholes, gives the mean velocity of flow, which is used in the calculation of the discharge.

Some preliminary tests were made for the purpose of determining the effect of placing the pair of electrodes in different positions in the cross-section of the aqueduct. Points at one-third depth, near the centre line of the cross-section; at two-third depth near this same line; and near the sides at varying depths were selected, and readings were taken, recorded and plotted. Not one of the computed mean times showed a disagreement from the average mean time of more than 0.2 of one per cent. These results, shown in figure No. 5, indicate that, for these lengths of aqueduct between manholes, there is no necessity of placing the electrodes at any particular spot. Similar experiments showed that no greater accuracy was obtained by throwing in the brine in any particular area in the cross-section. The conclusion is that complete diffusion of the brine throughout the water is obtained at short distances from the point of injection and, although the passage of water in the central portion of the aqueduct is more rapid than near the sides and invert, the observed mean time is not affected by the position of the electrodes.

The measurements of discharges as determined by the salt-velocity method were checked by the Venturi meter placed in the section of the pressure pipe line at the Falcon river crossing, which was also used to determine when the

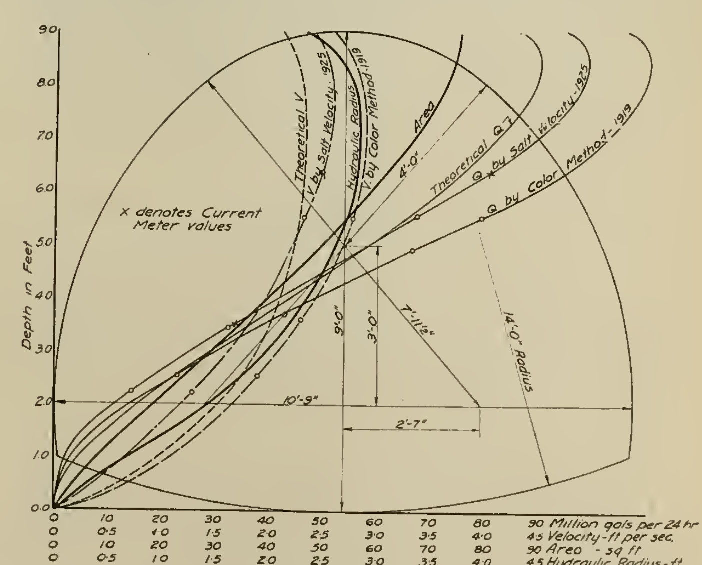

Figure No. 3.

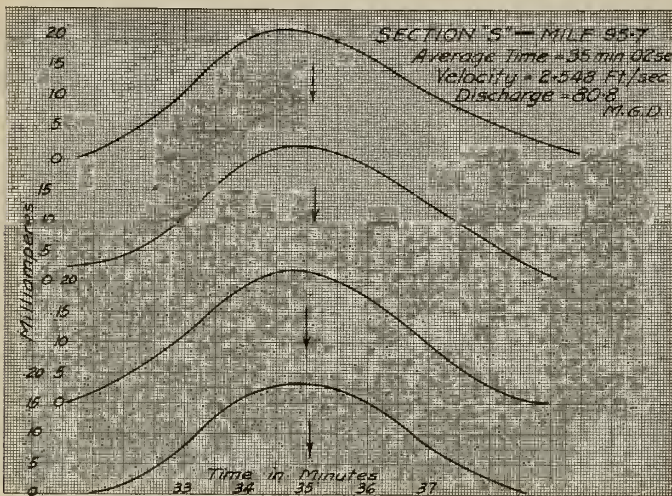

Figure No. 4.—Curves showing Electrical Conductivity.

flow was steady, and by metering the flow through a "boat house," an expansion of the aqueduct, with a Price current meter, a traverse of the boat house having been made. An attempt was made to use the current meter in the "S" section of the aqueduct, but the shape of the section precluded satisfactory measurements of flow. The current meter was fastened to a braced rod, as the weights commonly used were found to impede operation.

Three successive rates of flow were measured at all the manholes mentioned above, namely, 30 m.g.d., 67 m.g.d. and 80 m.g.d., as recorded by the Venturi meter, and each measurement was repeated on successive days. One series of measurements was made in the "S" section only of a flow of 14 m.g.d., but as the normal demand of the Greater Winnipeg Water District is nearly 30 m.g.d., and the reservoir capacity relatively small, only a limited time could be allowed for this reduced flow.

For all runs, the elevation of the mean water surface was obtained by carrying bench mark elevations down the manholes with steel tapes with sharp plumb bobs attached. Readings were taken by at least two men before and after each run, and if there was any difference noted mean values were used in the calculations for Q. Adequate precautions were taken to insure a steady flow during each run; whenever possible, the flow was regulated on the day prior to the measurement. In only one run was any trouble experienced from unsteady flow, when the average of several readings had to be used.

A comparison of results from the three methods of measuring discharges is seen in table No. 2.

Table No. 2.—Comparison of Results from Three Methods of Measuring Discharges.

Average Q (m.g.d.)			Per centage difference between "B" & "C"
By Venturi Meter A	By Current Meter B	By Salt-Velocity Method C	
30	33.45	32.5	3.
67	70.20	68.1	3.
80	80.98	81.4	0.5

As was to be expected, there is a closer agreement in the current meter results, and those obtainable by the salt-velocity method in the larger flows, when there is an increased ratio of fast water to sluggish flow. (The low velocities near the sides and bottom are inaccurately registered by the current meter.) For example, by increasing the flow from 67 m.g.d. to 80 m.g.d. the depth of water is increased 30 per cent, the velocity 40 per cent and the wetted perimeter very slightly. The comparison is seen more clearly in table No. 3.

Table No. 3.—Changes in Constants Resulting from Increase in Flow.

Flow increased (m.g.d.)	Increase in			
	Area sq. ft.	Depth ft.	Velocity ft. per second	Q sec.-ft.
From 30 to 67	21.7	2.17	0.48	35.5
From 67 to 80	5.3	0.60	0.21	13.4

The tests were made on lengths of aqueduct which were straight or nearly straight. Where curves existed, the location of the manholes precluded any attempt to measure the friction losses due to bends alone.

The times taken by the charged water to pass the electrodes and the distance between manholes are noted in table No. 4.

Table No. 4.—Time Taken by Charged Water to Pass Electrodes and to Traverse One Mile.

Flow	Station	Time taken to pass electrodes	Time taken to traverse one mile
14	Mile 95.7 to Mile 96.7	7 min.	68 min. 12 sec.
30	"	7 "	48 " 23 "
67	"	4 "	38 " 14 "
80	"	4 "	35 " 02 "

It will be observed that the length of water affected by the charge is over 500 feet at a point one mile below the point of injection. The degree of density, (as indicated by the increase in electrical conductivity), and also the close agreement in the position of the centres of area for consecutive tests of a constant flow are shown in figure No. 4. After the charged water had passed the electrodes, the needle of the ammeter remained steady. Thus, charges could be injected at regular intervals of, say, ten minutes and the needle would begin to deflect in exactly the same time interval as in the preceding test. It will be observed that

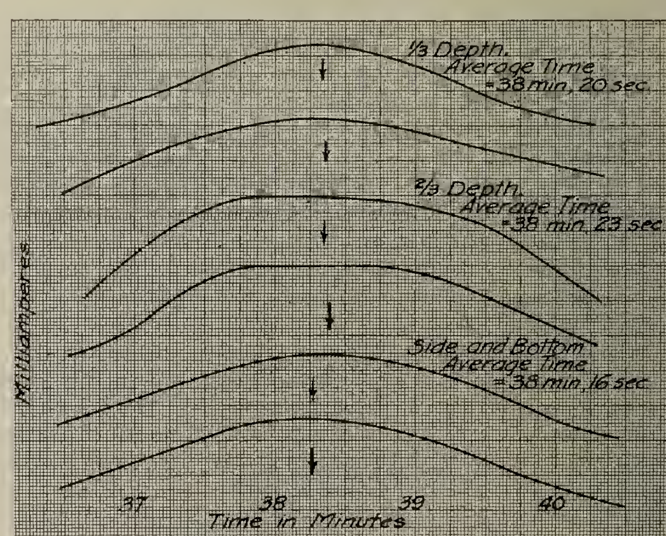

Figure No. 5.—Comparative Velocities over Section "S," Mile 95.7.

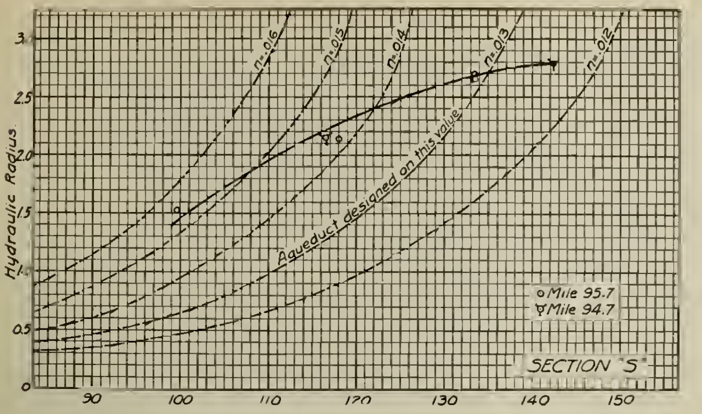

Figure No. 6.—Values of "C" in Chezy's Formulae.

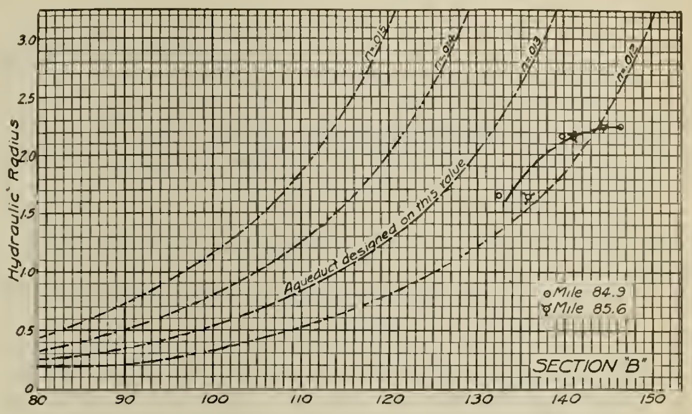

Figure No. 7.—Values of "C" in Chezy's Formulae.

although the peaks of the amperage-time curves occur at varying times in successive tests, there is a very close agreement in the centres of area. Thus, the claim that the centres of area give a true measure of the mean time of passage is substantiated by the results of the experiments.

It is believed by some engineers that the earlier deflections of the needle are caused by the passage of the fast moving water in the central portions of the stream, and the tailing of the curve by the slowly moving particles near the bottom and sides of the aqueduct; while the agreement of results, regardless of the position of the electrodes, would seem to indicate that the path of the current from one electrode to the other is through the entire cross-section of the stream, and not merely across the passage between the electrodes.

The deduced values of the coefficient of roughness and of other hydraulic constants are noted in the accompanying table and in figures Nos. 3, 6 and 7. For reasons stated above, tests of the 14 m.g.d. were made only on section "S," and the value of n for that flow is 0.0155. Values of 0.012 and 0.013 are obtained for the greater flows, which would appear to warrant the use of $n = 0.013$ in the design of the aqueduct. The corresponding value of Chezy's constant C is 140. The higher values of n in the 30 m.g.d. in the "S" sections may be explained by stating that these sections are situated about three miles from the intake and are subject to depositions of algae, notwithstanding the fact that these sections were cleaned thoroughly about a year prior to the date of making the tests.

In the "B" section, which is fourteen miles from the intake, the value of n was found to be fairly constant at 0.012, increasing slightly with decreasing flows. The corresponding value of C is about 140. The maximum discharge through the section is 96 m.g.d., 11 m.g.d. in excess of the designed value. The Q curve in the figure corresponding to figure No. 3 crosses the theoretical Q curve at a flow of 20 m.g.d., the mean velocity at that flow being about one foot per second.

The results show that the salt-velocity method is a simple, speedy, accurate and economical means of determining the condition of pipe lines. In the present case, four tests at each of the four stations were made in the time taken to traverse one section with the current meter. The degree of accuracy is noted in the figures. It would appear that the use of 0.013 as a value of n in the design of concrete structures may be considered good practice, also that concrete is a suitable material for the construction of aqueducts of this type, there being a very small loss in hydraulic efficiency during its six years of service.

The tests were carried out under the writer's direction by three graduate students in the Department of Civil Engineering, University of Manitoba, J. H. Grant, J. A. McFadden and F. T. Robertson, assisted by two senior undergraduate students, F. S. Adamson and J. M. Kennedy. C. W. Carry traced the curves and tables which appear in this paper. Thanks are due to W. M. Scott, chief commissioner of the Greater Winnipeg Water District, and his assistant engineers for assistance and advice, and to C. H. Attwood, district chief engineer of the Dominion Water Power Branch of the Department of the Interior, for the loan of equipment and for general direction of the current meter measurements.

Locomotive Feed Water Heating

Its Application and Advantages, Economies Effected under Operating Conditions and a Description of Various Types of Heaters in Use

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Mechanical Engineer, Central Vermont Railway Company.

Paper read before the Montreal Branch of The Engineering Institute of Canada, March 17th, 1927

The subject of locomotive feed water heating is becoming increasingly important from the standpoint of transportation. This is due to the fact, that with the constantly mounting expense of operation, any device that can be applied to a locomotive to increase its efficiency as an operating unit and yet not introduce elements detrimental to its handling in service must receive serious consideration.

Whereas the preheating of the boiler feed water has long been standard practice in stationary and marine service, it is only in recent years that it has become sufficiently developed to be applied generally in the locomotive field.

There have been many papers written on this subject from a purely theoretical standpoint, but this paper is intended to present the subject in general, to emphasize the benefits which may be expected from the application of a feed water heater, and to present some actual results obtained in service.

Feed water heaters have received attention from the days of the earliest locomotives and experiments have been carried out with many different designs. However, in the last few years the need for a successful heater has been emphasized by the increasing cost of locomotive fuel.

As a result, a feed water heater was produced and applied to a large Pacific type locomotive in the United States in the year 1916 which has since developed into one of several very satisfactory designs. Although the further development was somewhat hindered by war conditions, yet at the present time approximately 4,100 are in service on locomotives on this continent.

Meanwhile, on European railroads this same development has been taking place only somewhat more rapidly on account of the higher proportionate cost of fuel and the need for a more rigid operating economy, and at present there are several thousand locomotives equipped with devices of this nature.

Advantages to be Derived

The savings and benefits to be derived by the application of feed water heaters to locomotives take several different forms, all of which should be taken into account. First is the important benefit accruing from fuel saving. A second equally important one is the possible increase in boiler capacity attained by its application whereby a heavier tonnage train can be handled over a division in the same or shorter time, resulting in an increased gross ton-miles per hour figure. Which of these two points should be stressed in any particular application depends upon the physical characteristics of the road and equipment.

The maximum horse power of a locomotive, which, of course, is the period of the greatest steam consumption, is not developed until a speed of around twenty-five to thirty miles per hour is attained, assuming that the locomotive is also being worked to the maximum. Therefore, if the territory in question is a low gradient line where, in order to obtain the best transportation results heavy trains are to be handled at speed, any increase in boiler capacity is a direct boon to operation and this point becomes the more important of the two. At the present time, one of the principal aims of locomotive design is to increase the capacity and efficiency of the boiler.

On the other hand, if the profile of the engine district has some heavy grades and the boilers are reasonably well designed, then, under ordinary working conditions, the theoretical maximum steam consumption will never be reached, for when the locomotive is working the hardest it will be at a relatively slow speed while on the remaining stretches the locomotive will be underloaded, due to the fact that the grades have set the tonnage rating. Under these conditions, which exist in many places, the feed water heater is not required as a boiler capacity increaser, but full advantage can be taken with it as a fuel saver. Other lines very often are choppy, that is, they have numerous sharp grades that cannot be taken at momentum and which limit the tonnage rating. In many such cases at the present time booster engines of the trailer and tender truck types are being used with the regular locomotives so as to assist at these hard points, resulting in a more economical tonnage loading over the engine district. As this becomes an added drain on the

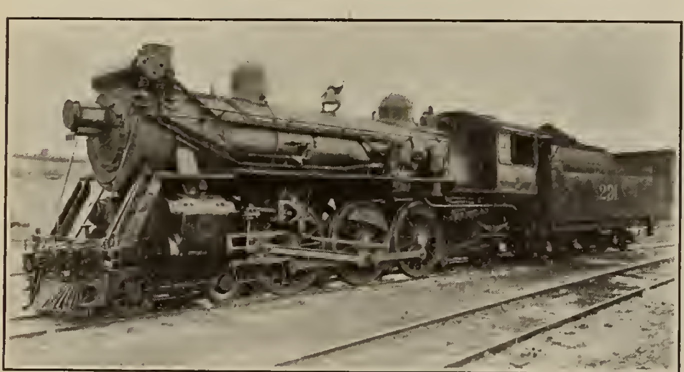

Figure No. 1.—Locomotive Equipped with Elesco Heater.

Figure No. 2.—Locomotive Equipped with Coffin Heater.

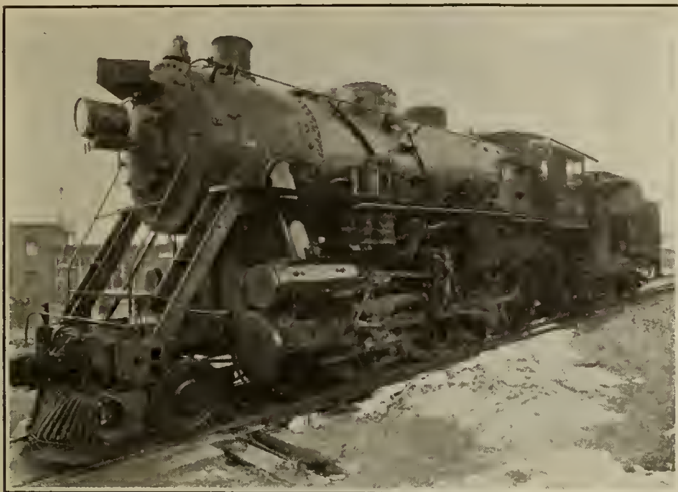

Figure No. 3.—Locomotive Equipped with Worthington Heater.

boiler, the application of feed water heaters will increase their capacity and so furnish sufficient steam at the critical points.

Saving in Fuel

Now, as to fuel saving, a few explanatory figures will be given as to how this can be arrived at theoretically and then later some figures obtained in actual service.

It has been found that out of every pound of coal fired into the firebox of a locomotive only about seven per cent is turned into useful work at the drawbar. The other ninety-three per cent is consumed partly in the operation of the various auxiliaries such as the air pump, stokers, power operated grate shakers, etc., while the greater part is lost through the exhaust steam from the cylinders, hot gases from the stack, pops and ashes.

The hot gases from the stack represent approximately twenty-five per cent of the total and the exhaust steam about fifty-eight per cent. Therefore, it can be seen that the greatest loss is in the exhaust steam and that this provides a source of power which, if reclaimed, will result in substantial savings.

In the many years of experimentation in the past, feed water heaters were designed to utilize the loss represented in the exhaust steam, while economizers were developed to reclaim that in the gases from the stack. This latter development has not become successful as yet for two reasons. First, the very hot exhaust gases, ranging from temperatures of 450° to 1,100° Fahrenheit, in striking the cold economizer tubes, cause a film of moisture to be precipitated on the outside surface of the tubes, and the soot which naturally collects forms a non-conductive medium, preventing the transfer of heat to the feed water. Secondly, a chemical action is set up in the feed water which causes the precipitation of part of the solids in this water, thus forming a scale on the water surface of the tubes. For these reasons and the fact that the lack of space in the locomotive front end does not allow the application of a two-stage economizer, the successful development of an apparatus of this type has been prevented, although at present, outside of European experiments, one company at least in America

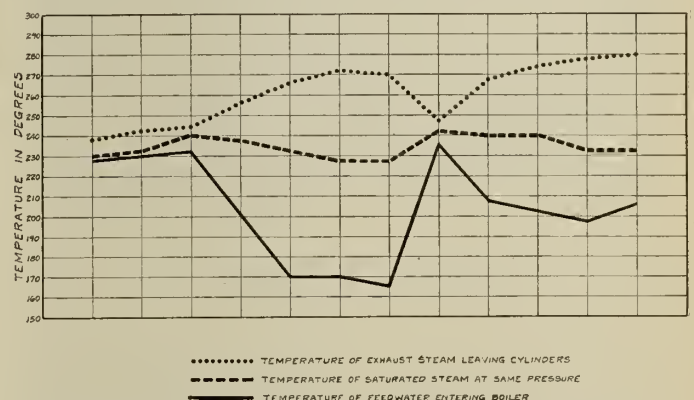

Figure No. 4.—Curve showing the Decrease in Feed Water Temperature Due to Superheat in the Exhaust Steam.

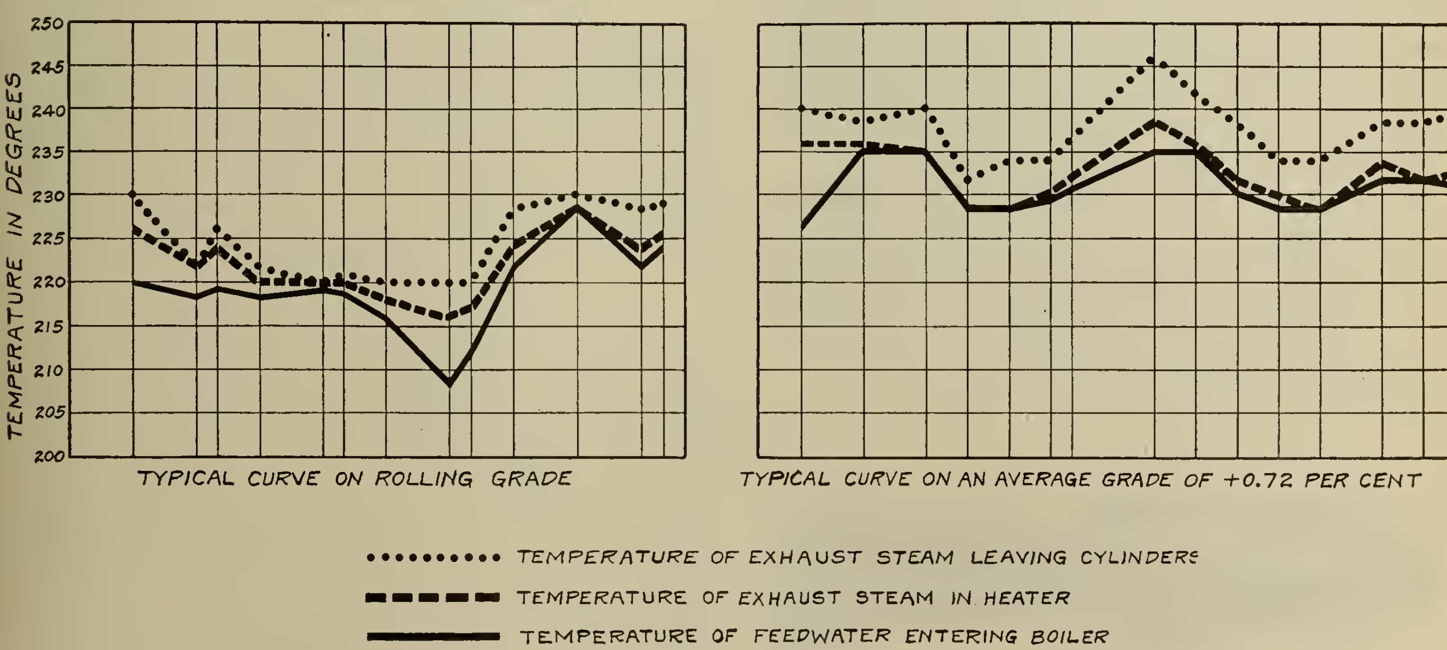

Figure No. 5.—Curve showing Temperatures on Light and Heavy Grades.

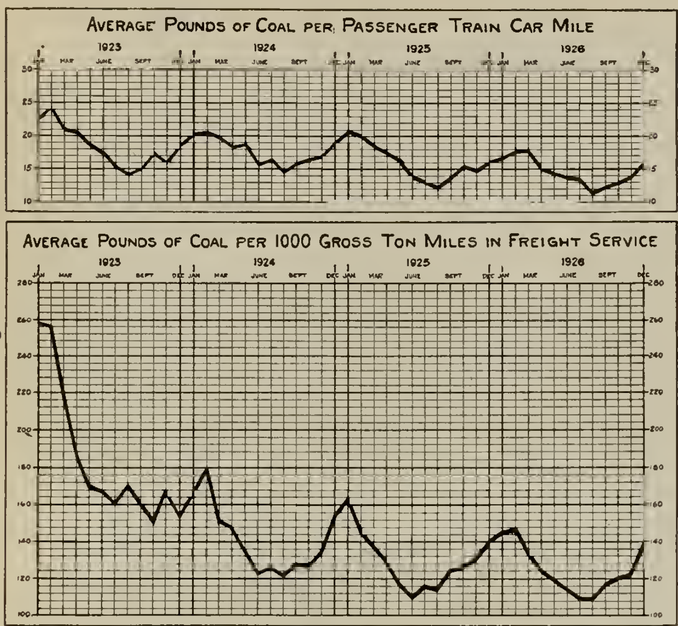

Figure No. 6.—Locomotive Fuel Consumption in Passenger and Freight Train Service.

is working on a combination feed water heater economizer system for locomotive use. There still remains, however, the possibility of saving a portion of the heat wasted in the exhaust steam by transferring it to the feed water before the latter goes to the boiler, and it is this phase of the problem that will now be considered.

The unit of heat measurement is, of course, the British thermal unit, (B.t.u.), which is the amount of heat required to raise the temperature of a pound of water one degree, from 62° to 63° F. If we assume that the average temperature of the water in the tender tank, summer and winter, will be 55°, it is found on consulting tables of the properties of steam that 1,311 B.t.u. must be supplied to each pound of water at 55° in order to convert it into steam at 200 pounds boiler pressure with 250° of initial superheat, the conditions which will be assumed as an example. Further, it will be assumed that, considering the service in which the locomotive is to be operated and the draught requirements, the average running back pressure will be 5 pounds, and steam tables show that the temperature of exhaust steam at this pressure will be 225° F.

A properly designed feed water heater with sufficient heating surface to give an adequate transfer of heat should be able to bring the temperature of the feed water up to within about 10° of the temperature of the exhaust steam, or, say, 215° for the engine in question. The temperature of each pound of feed water would therefore be increased from 55° to 215°, or through 160°, while a portion of the exhaust steam would be condensed at 225°.

It is now possible to estimate the saving from the operation of a feed water heater under these conditions, and it will be assumed that the locomotive requires 38,000 pounds of steam per hour to develop its maximum power in the cylinders and that five per cent of its boiler capacity is required to cover radiation losses, requirements for train heating, etc. A total boiler capacity of 40,000 pounds of steam per hour is therefore assumed, which also means that 40,000 pounds of feed water per hour will have to be heated through 160°. The heat required per hour to heat the feed water is therefore:—

$$40{,}000 \times 160 = 6{,}400{,}000 \text{ B.t.u.} \quad (1)$$

From the steam tables it is found that each pound of exhaust steam in being condensed from steam at 225° to water at the same temperature supplies 962 B.t.u. to the feed water; the amount of exhaust steam required to heat the feed water is therefore:—

$$\frac{6{,}400{,}000}{962} = 6{,}650 \text{ pounds per hour} \quad (2)$$

The total heat expended in producing 40,000 pounds of

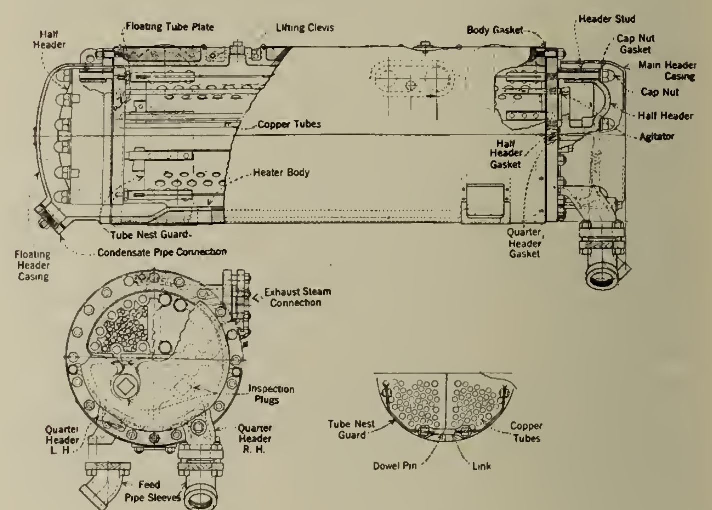

Figure No. 8.—Details of Elesco Heater.

superheated steam per hour from cold water at 55° is:—

$$1{,}311 \times 40{,}000 = 52{,}440{,}000 \text{ B.t.u. per hour} \quad (3)$$

In order to effect an economy of one per cent on this amount, it would have to be diminished by one one-hundredth or 524,400 B.t.u. per hour; but as appears from (1) the feed water heater actually saves 6,400,000 B.t.u. per hour, so that the saving on the total heat expended is:—

$$\frac{524{,}400}{6{,}400{,}000} = 12.2 \text{ per cent} \quad (4)$$

Further, this economy is effected by the use of a proportion of the total exhaust steam which will amount to, (after allowing for that volume of exhaust steam from the auxiliaries which may be utilized in the feed water heater), between fourteen and fifteen per cent of the total exhausted from the cylinders.

The foregoing shows that an appreciable and direct saving can be obtained from a feed water heater in regard to fuel economy. There are, however, other factors that work both with and against it. First, there is the added drain on the boiler due to the live steam consumption of the feed water pump. This will vary from one and-one-half to two and one-half per cent of the boiler capacity, depending on the type of pump used and its physical condition. As an

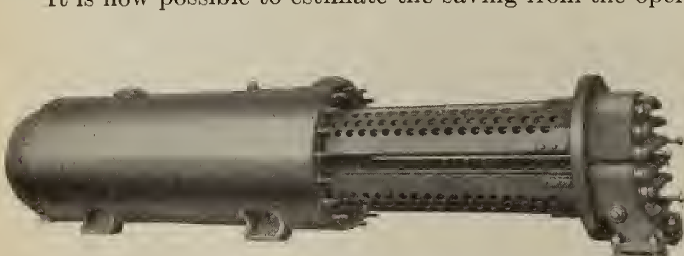

Figure No. 7.—Elesco Heater.

Figure No. 9.—Two-Cylinder Elesco Pump.

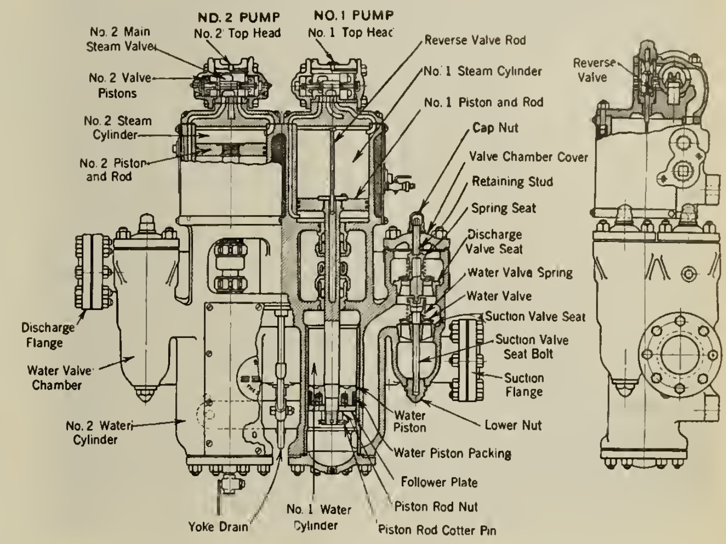

Figure No. 10.—Details of Two-Cylinder Elesco Pump.

offset to this apparent loss is the increased evaporating efficiency of the boiler obtained by the lower fuel rate required. As has already been seen, a large amount of heat has been reclaimed from the exhaust steam, which, of course, has resulted in an increased evaporation of pounds of water per pound of coal. Therefore, for the same boiler output, less fuel is required and the firing rate in pounds of coal per square foot of grate per hour is decreased. This will increase the boiler efficiency approximately four to five per cent, depending on the service in which the locomotive is used and the point of cut-off at which it is worked.

As less coal is burned, there is formed a smaller volume of gases that has to be exhausted through the stack. This in turn means that the exhaust blast can be softened and a reduced cylinder back pressure maintained. A reduction of two pounds in back pressure should readily be obtained which on a two hundred pound boiler pressure engine will be an increase in cylinder power of one per cent.

A detrimental factor which can generally be expected when a feed water heater is applied to an old locomotive is a loss in initial superheat. This has been found to average about twenty degrees on some locomotives tested. The loss is caused by the lower fuel consumption whereby the ratio of the exhaust gases to the steam consumption is lessened. In new locomotives this fact can be taken care of in the design and a larger proportionate superheating surface can be installed. However, this point is not particularly serious as the apparent loss is partially at least compensated for in the reduced cylinder back pressure.

Effect of Superheat in Exhaust Steam

This brings up a point which the writer believes is not thoroughly understood at present and which will have to be worked out in the matter of design and proportion, i.e., the effect of superheat in the exhaust steam. It has been found by experience that the transfer of heat to the feed water is quite seriously affected when the temperature of the exhaust steam entering the heater is above that of saturated steam of the same pressure, and that the greater this difference becomes the more marked becomes the effect. Therefore, if a locomotive is so designed and worked in service that the exhaust steam from the cylinders is in a superheated form, the effect, particularly in the closed type of feed water heater, is to reduce the delivery temperature of the feed water, for there is apparently but little heat absorption through the tubes in the area of this highly heated steam.

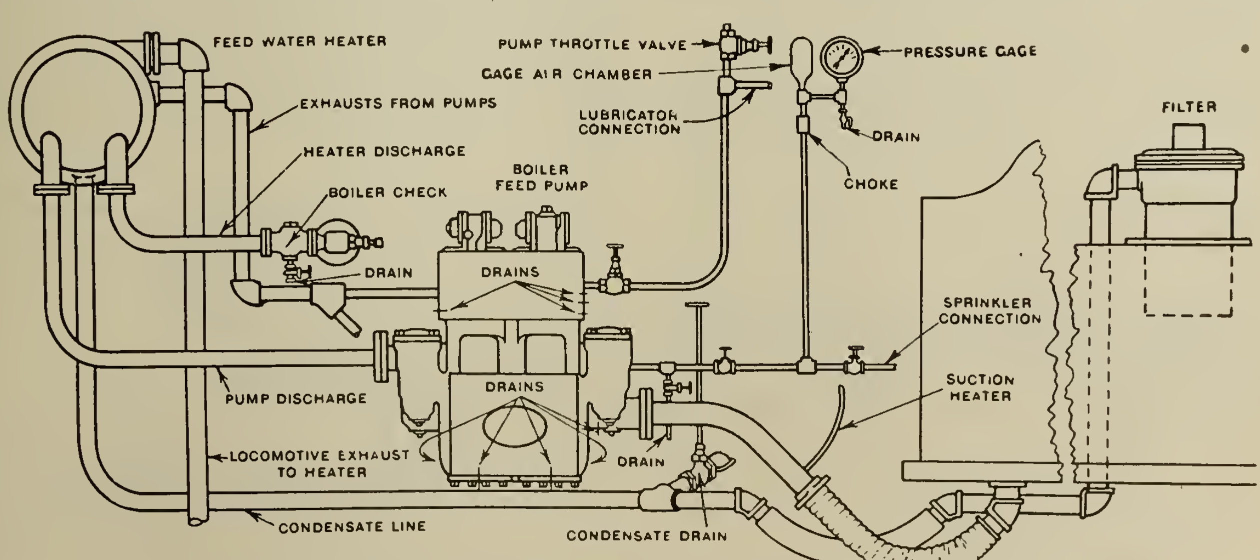

Figure No. 11.—Piping Diagram showing Layout and Application of Elesco Heater.

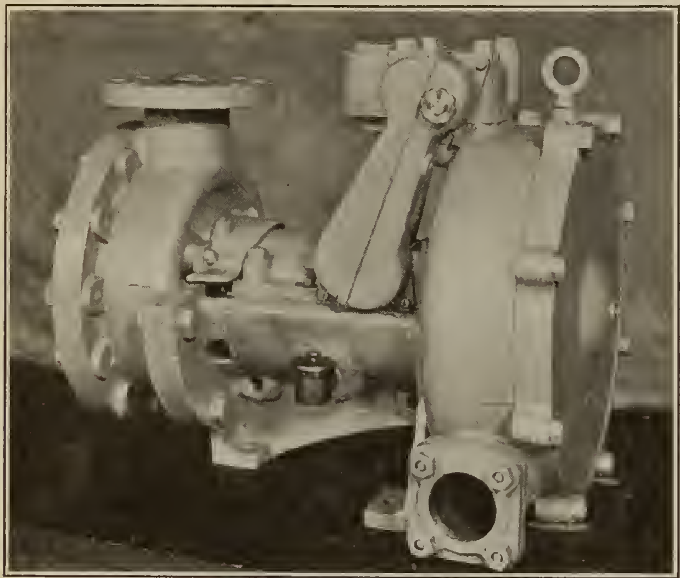

Figure No. 12.—Coffin Pump.

This has been found to exist as the result of many test readings and may be the result of several contributing causes. A typical curve illustrating this condition is shown in figure No. 4.

Saving of Water

Another feature of the feed water heater which is often important from the transportation viewpoint is the water saving. In all systems in use in America, the condensate from the exhaust steam utilized in the feed water heater is saved and returned to the boiler. This water, which varies in amount somewhat with the working of the locomotive, approximates 10 per cent of the whole as an average. This condensate is in effect distilled water and thereby eliminates immediately a corresponding per cent of the impurities carried in with the raw water, and will prevent to that extent the formation of scale and the accumulation of mud in the boiler. In bad water districts the good effect of this is very noticeable on not only the maintenance of the boiler but on the cost of the water, as a smaller amount of the treated water is required. In fact, one large western railroad system in the United States found that feed water heaters paid for themselves on the item of boiler maintenance alone. The return of the condensate to the tender virtually results in an equivalent larger tank and in many cases eliminates a water stop with its attendant delays.

The Injector

It may not be amiss to say a word here about the well-known injector. In itself it is a feed water heater, inasmuch as the live steam required by it to force the water into the boiler is condensed and mixed with the water, thereby heating it to a high temperature. This, however, does not result in other than an incidental saving, as the heat units used are a drain on perhaps an overloaded boiler and not a recovery of the heat units going to waste. An injector has the advantage of being a simple device, light in weight and easily maintained, although at its most efficient state it will deliver only about ten pounds of water to the boiler per pound of live steam, while the various feed water heater pumps will deliver anywhere from forty to sixty-six pounds.

The exhaust steam injector is also being developed into a satisfactory device, and it utilizes in its operation exhaust steam the proportion of which varies with the working of the locomotive. If standing or drifting, live steam has to be used entirely. The injector is light in weight compared with a feed water heater and much cheaper, but at present the control is rather complicated. About three hundred and fifty have been applied in America, although quite a number are in service in England.

Results

Some average results and figures obtained in actual service from some fifty feed water heaters of both the closed and open types, operated in freight and passenger service, are given in the following table and curves. The curves shown in figure No. 5, which are of a representative run, show the heat transfer obtained from the exhaust steam through the heater to the delivery water.

Table No. 1 gives the results of a number of typical runs. No doubt some may take exception to the high percentage of savings shown, since they are so much in excess of possible theoretical calculations. In all cases, however, the coal and water were carefully measured. Accurate records were kept, and they are borne out by check records that are constantly being made and by fuel consumption statistics. There are so many elements affecting and improving the operation of the locomotive when a feed water heater is applied that it is rather impossible to separate one from another in ordinary running and test service. Therefore, a complete explanation cannot be made of them, but these results can be taken as the average obtained in every-day service as shown in table No. 1.

Effect on Terminal and Shop Facilities

There is another phase of the subject that should be considered equally as well as the saving in fuel and the train operating benefits, and that is the effect on terminal and shop facilities due to the added maintenance expense. This not only directly affects the locomotive as an economical unit but might seriously increase shop forces. However, from records carefully compiled, in a certain instance, this

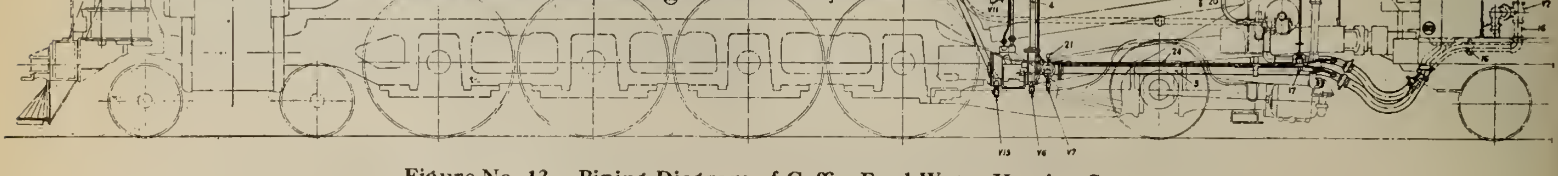

Figure No. 13.—Piping Diagram of Coffin Feed Water Heating System.

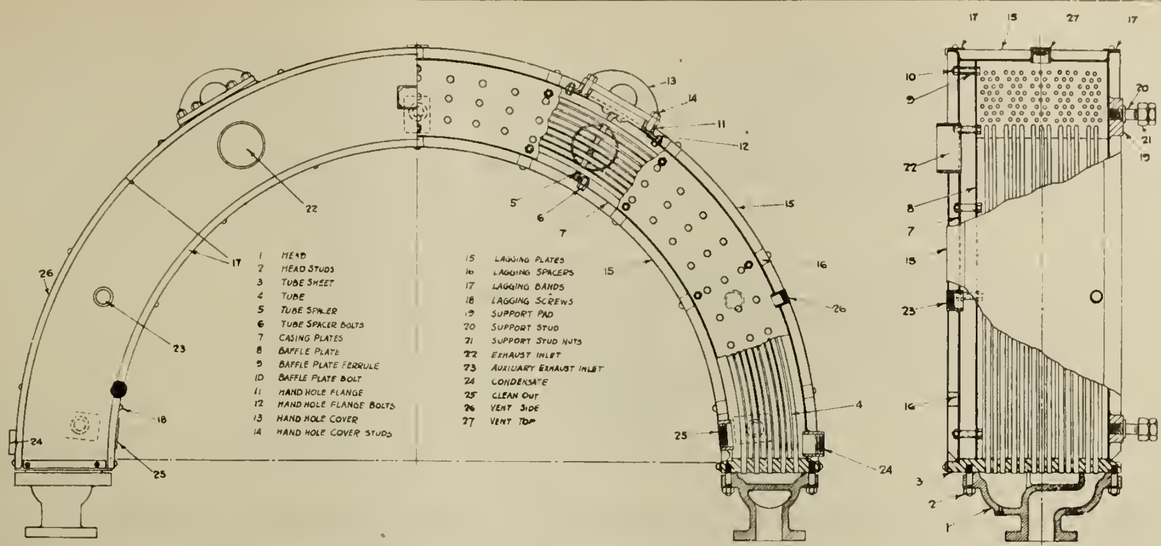

Figure No. 14.—Details of Construction of the Coffin Heater.

expense including everything in regard to maintenance, that is, labour, material for repairs, running expenses, general overhaulings, and monthly inspections, has been found to average 24.1 cents per 100 miles. This represents a test of a set of twenty-three heaters, including both closed and open types that were between three and four years old. For another set of twenty-four heaters under two years old this average cost is only 4.15 cents per 100 miles. These figures represent maintenance costs in a good water district and would naturally be increased under more adverse conditions.

Savings Effected

To show just what these savings will amount to as regards locomotive and fuel performance, the following figures are given:—

First cost of feed water heater applied..........	$2,500.00
Interest on investment and deferred maintenance at 12 per cent..............................	300.00
Maintenance for 40,000 miles at 24.1 cents per 100 miles	96.40
Total cost per year.....................	$ 396.40
Cost of 2,947 tons of coal (injector fed engine) at $5.35 per ton............................	$15,766.45
Average fuel saving in freight service of a feed water heater equipped locomotive over one injector fed (from table No. 1), 11.5 per cent.	338 tons
Saving in fuel, 338 tons coal at $5.35 per ton.....	$1,808.30
Net saving per year of feed water heater equipped locomotive	$1,411.90

As a concrete illustration, the Central Vermont Railway can be considered, on which at the present time forty-eight and one-half per cent of the locomotives are equipped with feed water heaters, while within the next few months this will be increased to sixty-six per cent. These feed water heater equipped locomotives handle approximately ninety-five per cent of the road freight tonnage and fifty per cent of the steam locomotive operated passenger traffic in car miles. A very appreciable saving in fuel has been obtained since the application of feed water heaters, and this is shown graphically by the curves in figure No. 6. It is not intended to convey the impression that all the improvement is due to this one source, as it is not. Part is attributable to the scrapping of obsolete power and its replacement by modern units and part to better operating conditions. This in turn cuts down train delays, but, nevertheless, since the application of feed water heaters was started the fuel consumption rate, as shown by these curves, has decreased with each new lot of heaters applied, and therefore bears out very clearly the fact of the economies to be obtained from this source.

Various Types of Heaters in Use

The several designs of heaters that are being developed on American railroads can be divided into two general types, the closed and the open. In the first the feed water

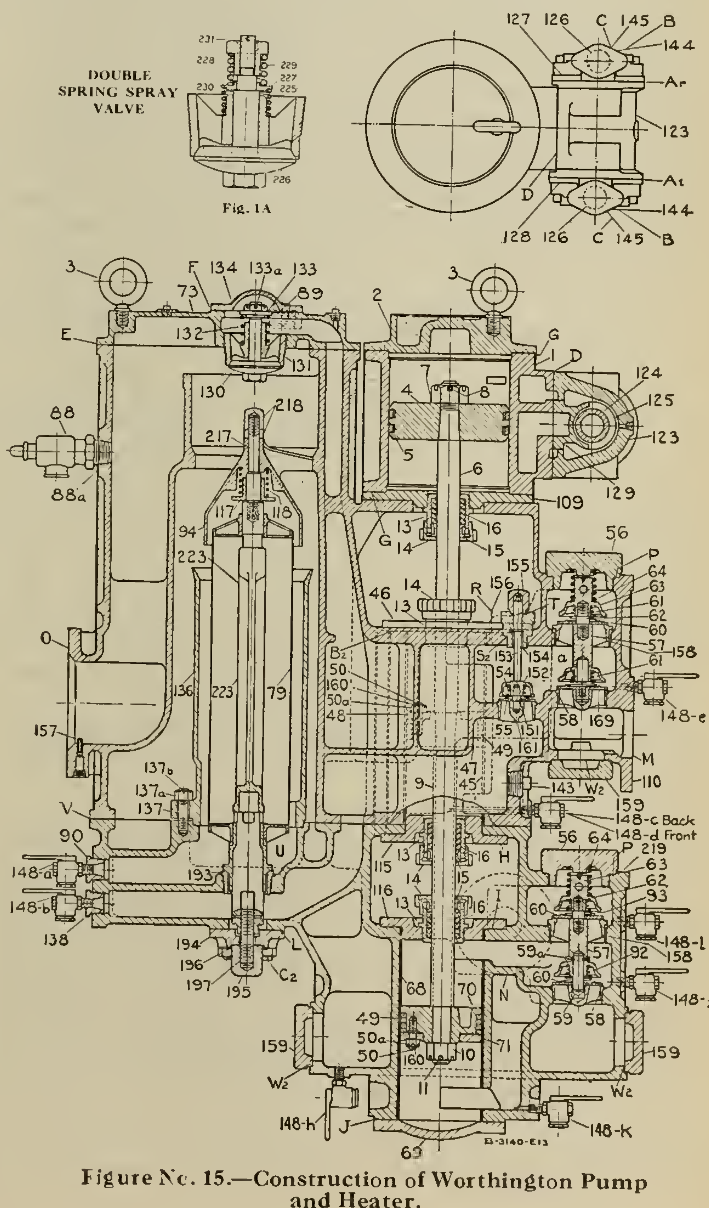

Figure No. 15.—Construction of Worthington Pump and Heater.

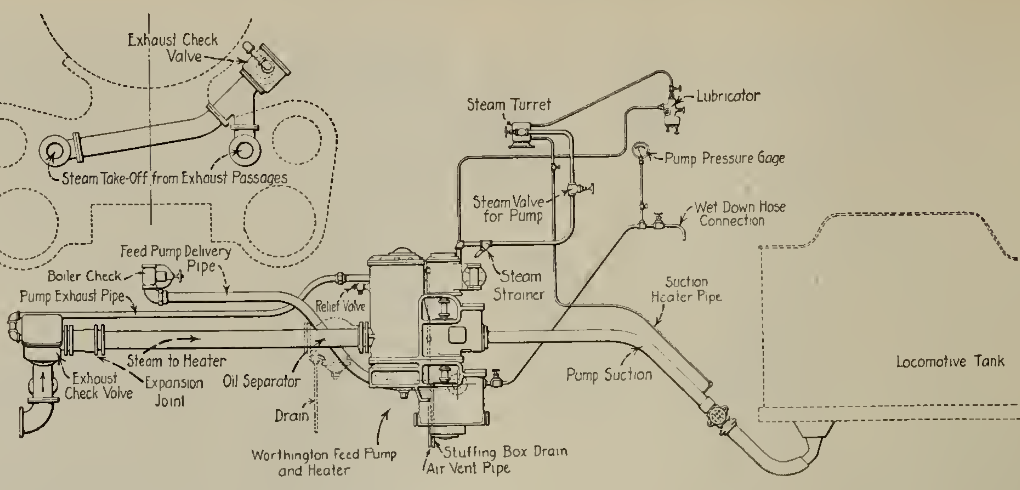

Figure No. 16.—Piping Diagram showing General Layout of a Typical Application of Worthington Heater.

does not come into direct contact with the exhaust steam, while in the latter type the exhaust steam is condensed by and is carried on into the boiler with the feed water.

In the closed type, the two heaters that are most extensively applied are the Elesco and the Coffin.

The Elesco consists of a cylindrical heater containing four nests or passes of small tubes located generally on top of the smoke box ahead of the stack which allows the condensate to drain back to the tender tank by gravity. This heater is shown in detail by figures Nos. 7 and 8. The exhaust steam is taken from the cylinders and surrounds the small tubes through which the feed water is forced to the boiler, while the condensate formed from the exhaust steam drains back to the tank and is then used over again. A two-cylinder pump, shown in figures Nos. 9 and 10, located on the side of the boiler and driven by live steam, sucks the feed water from the tank and forces it under pressure through the heater into the boiler. The piping diagram, figure No. 11, shows the general layout and application of the Elesco feed water heater.

The Coffin feed water heater is designed in a curved shape to conform to the contour of the locomotive smokebox. It is rectangular in cross-section and has five nests or passes of small tubes surrounded by the exhaust steam, through which the feed water is forced by the pump. This heater is vented to the air and the condensate from it is carried back to a small auxiliary heater in the tank, where it is thoroughly mixed with and preheats the tank water before going to the pump, thereby increasing the efficiency of the heater. The pump is the centrifugal type with two rows of buckets in the steam end and has an automatic governor which limits its speed. It is light in weight and can generally be located on a bracket attached to the engine frame under the cab. If desired, the exhaust from the pump can be run into the condensate line and returned to the auxiliary heater for preheating purposes. Figure No. 12 shows the Coffin pump, while figure No. 13 illustrates a typical application, and figure No. 14 details of the construction of the Coffin heater.

Of the open type heaters, the Worthington is the outstanding example, and practically all of this type applied so far are of this design, which consists of a combined pump and heater in one unit. Figure No. 15 shows the construction of the pump and heater, while figure No. 16 is a diagram giving the general layout of a typical application. This pump is steam-driven and consists of three cylinders arranged in tandem form with the three pistons on one common piston rod. The top cylinder is the steam unit, while the middle cylinder draws the cold water from the tank and delivers it to the exhaust steam chamber of the heater section in the form of a spray. This spray in condensing the exhaust steam absorbs the heat units and the mixture of the hot water and condensate is then forced into the boiler from the bottom or hot water cylinder. An oil separator is applied in the exhaust steam line when desired so as to prevent the carrying into the boiler by the feed water of the lubricating oil which may be in suspension in the exhaust steam.

The other closed type that is now attracting attention is the Dabeg, a successful Austrian design that has been applied on several American locomotives. In this, as in other open type heaters, the cold water is sprayed into the exhaust steam chamber, but instead of having a steam-driven pump it is actuated mechanically.

There are other instances of the application of special type and experimental heaters, but the foregoing covers the four principal ones now in service in Canada and the United States.

Table No. 1.—Results Obtained on a Number of Typical Runs.

Service	Type of Engine	Length of Run in Miles	Weight Train in Tons	Per Cent Increase in Evaporation Feed Water Heater over Injector	Per Cent Decrease in Fuel Consumption Feed water Heater over Injector	Pounds Coal per Square Foot Grate per Hour	
						Feed water Heater	Injector
Fast Passenger	4-6-2	186	650	23.9	22.8	49.9	62.1
Local Passenger	4-6-0	117	284	19.0	15.8	39.5	47.9
Fast Freight	2-8-0	117	1590	12.8	15.2	50.6	56.6
Fast Freight	2-8-0	117	1540	19.7	9.7	53.5	57.1
Slow Freight	2-8-0	72	1180	24.0	9.7	50.2	57.3

The Use of Local Materials for Concrete Construction

Precautions Taken in Construction of Roads in Brant County, Including the Predetermination of the Strength of Concrete

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County Engineer, Brant County, Brantford, Ont.

Paper read before the Hamilton Branch of The Engineering Institute of Canada, March 16th, 1927

It seems only a very few years ago that gravel for ordinary concrete structures was accepted or rejected by what might be called the palm-of-hand method. A small quantity of the finer gravel was rubbed between the palms of the two hands, and if it left a very dirty mark it was rejected or if it felt smooth and soft it might be rejected. The experiments carried out by the Lewis Institute under Professor Duff Abrams, M.E.I.C., have done more to disseminate an accurate knowledge of concrete ingredients than any other theory that has been advanced in modern times, and, to the writer's knowledge, there are not any simpler methods of testing concrete aggregates, and it is intended to demonstrate in this paper that results can be obtained from doubtful material by the use of these methods which should give the engineer absolute confidence in his choice of aggregates.

The fundamental theory put forward by the Lewis Institute is the water ratio theory which is that, " for given materials and conditions of manipulation, the strength of concrete is determined by the ratio of the volume of mixing water to the volume of cement so long as workable mixtures are obtained. In other words, if one cubic foot of water is used for each cubic foot of cement in a concrete mixture, the strength at a given age is fixed regardless of what quantities of other materials are used, so long as the mixture is plastic and workable and the aggregates are clean and made up of sound durable particles. The significance of this important conclusion is more readily appreciated when the cement is thought of as a glue binding the aggregates together. The adding of excess mixing water serves only to dilute the glue and reduce the strength. The quantity of cement, the plastic condition or workability of the concrete and the size of the aggregate affect the strength of concrete only insofar as they affect the quantity of water required in the mix. If the other conditions are maintained constant the strength of concrete is increased by:—

(1) Mixing the concrete drier.
(2) Increasing the cement contents.
(3) Using coarser aggregates.

" Each of these changes, or combination of changes in the mixture, reduces the water ratio and the strength of the concrete is increased as the water ratio is decreased. The limit to which these changes may be carried is determined by the plasticity of the concrete. The amount of mixing water used must be sufficient to produce a plastic mixture, and the aggregate must not be too coarse for the amount of cement used."

To make use, then, of local materials which without careful testing are of doubtful quality, the first points to be determined are whether they are clean and sound. The importance of using local materials is very readily understood when the high freight rate still existing for such low grade commodities as gravel, sand and crushed stone is considered.

In addition to the water ratio theory, there is what is known as the fineness modulus of the aggregate, which has been more definitely defined by the Lewis Institute as " assuming a given consistency which should always be as stiff as the nature of the work permits, and a given mix, (proportion of cement to volume of mixed aggregate), the strength of the resulting concrete depends on the size and grading of the aggregate." In general, the larger and coarser the aggregate, the stronger will be the concrete. Coarse sand will produce stronger concrete than fine sand, while stone or pebbles in which the larger size predominate will produce stronger concrete than smaller stone or pebbles.

To determine the fineness modulus of an aggregate, it is necessary to make a simple sieve analysis. A set of standard square mesh sieves is used, each sieve having a clear opening double the width of the next smaller size; these sizes are 100, 50, 30, 16, 8 and 4 meshes per linear inch and 3/8-inch, 3/4-inch and 1½-inch. The percentage of aggregate coarser than each sieve is weighed, the sum of these percentages divided by one hundred is called the " fineness modulus." This is the most convenient method and an extremely simple one for making a comparison between any aggregates or combination of aggregates.

In order to illustrate the principles outlined above the details of the tests conducted in connection with the laying of a rural pavement in Brant county will be described. The choice of three or four deposits of local material was settled during the previous winter by the result of colour and silt tests and sieve tests to determine the grading of pit run material. An abrasion test was obtained from an outside source which proved the aggregate to have a French coefficient entirely suitable for concrete pavement.

A field laboratory was established in the pit consisting of an ordinary caboose on wheels with a bench, a set of scales weighing decimally up to twenty-five pounds, a set of standard sieves from 1½-inch to 100 meshes, a heater for drying samples, some 3 per cent sodium hydroxide, twelve-ounce prescription bottles, a sampling sheet, trowel, etc.

During the use of this local material in the construction of the concrete pavement, daily colour and silt tests were taken. These well known tests need hardly be described. The colour proved satisfactory and the silt by decantation test ran from 0.08 to 2.5 per cent, with an average for the season of 2 per cent. Thus the situation at this point was that the material was found to be comparatively clean and sound.

The gravel pit which was used in preference to imported material was such that when opened on a long face there was a very considerable body of coarse sand at one end of the pit and a fairly well graded gravel at the other end. The equipment used was two waggon loaders of the ordinary type discharging into a batch hopper at sufficient elevation for the hopper to empty into compartments in trucks. On the top of the hopper a sloping grizzly was arranged with the bars set slightly fanwise. With the waggon loader discharging on these bars, stones were found to jam continually when the bars of the grizzly were set parallel and a slight fanning of the bars overcame the difficulty. The waggon loaders, instead of working into the face of the material, were stationary, working only into a pile of gravel which was supplied by teams and slip scrapers. It was thus readily possible to change the mixture of gravel in the pile in front of each waggon loader by increasing the number of scraperfuls of sand or of coarser material.

The sampling of the gravel was done as follows:—A one hundred pound bag was filled from the discharge of the batch hopper, this was spread on the canvas sheet, thoroughly mixed, spread flat in a circle and quartered and a sample of about twenty-five pounds was dried. When dry, twenty-five pounds of this material was accurately weighed.

The strength of concrete aimed at in the pavement was 3,000 pounds at twenty-eight days. Hand-finishing was adopted, and for this result a fineness modulus of 5.8 was sample was put through the sieves and its fineness modulus obtained and instructions immediately given to the teamsters as to how the proportions of fine and coarse in the piles in front of the loaders should be varied to obtain the correct fineness modulus. Three samples of aggregate grading obtained are given in table No. 1.

An inspection of these three gradings will show that (*A*) has too high a proportion of fine material as reflected in the low fineness modulus while (*C*) has too small a proportion of fine material as reflected by the high fineness modulus. Both are readily corrected by adjusting the amount of fine and coarse material fed to the loaders, and sample (*B*) shows the correct fineness modulus for the strength of concrete determined upon.

The quantity of water could not be mechanically governed within very fine limits. The mixer had an automatic measuring pump which, while comparatively accurate, was, of course, entirely in the control of the operator, who could throw his lever twice for the same batch as well as once. Very strict inspection and the integrity of the operator was all that could be relied on for control of the water, except the constant use of the slump test.

If the mixed concrete had to be helped down the spout at the discharge of the mixer the concrete was sure to give

Table No. 1.—Determination of Fineness Modulus of Three Samples of Aggregate Grading.

Sieve sizes	100	48	28	14	8	4	3/8	3/4	1½	Fineness Modulus
(A) Percentages retained....	98.2	97.5	90.9	76.9	60.6	44.8	30.6	16.2	2.5	5.2
				Fine 55%		45% coarse				
(B) Percentages retained....	98.6	97.7	90.5	80.1	72.1	61.9	46.9	25.5	6.9	5.8
				Fine 38%		62% coarse				
(C) Percentages retained....	98.9	98.2	96.2	92.2	85.6	74.2	60.3	38.6	12.5	6.6
				Fine 26%		74% coarse				

set and became the daily task of the tester and sampler in the pit.

From Professor Abrams' table, the strength of concrete to be obtained is decided from a combination of the three factors slump, (governing water ratio), volume of cement and fineness modulus. The average, for the materials used, gave a mixture of about one to four. Allowance was made each day for the increase in volume of the aggregate, due to moisture, so that an unduly rich mix would not be obtained.

Bulking of the material due to its moisture content was investigated by examining another twenty-five pounds of the same sample. The bulking of the aggregate ran from 8½ to 16½ per cent, the average being 11 per cent and allowance was made on the basis of dry aggregate in fixing the quantity of cement used. The dried twenty-five pound a satisfactory slump, and a man working near the discharge had a hoe with which he continually cleared the chute. Slump tests were taken as often as six times a day and the average result obtained was one inch. The slump test cone was filled always by the same man. The twelve inches of the cone were filled in three layers, rodding each layer thirty times with a pointed steel rod. Test cylinders were taken in an exactly similar manner, the material in all cases being shovelled off the road and put into the slump cone or test cylinder.

The test cylinders were rodded in the same manner as the slump cones, and were tooled off and set aside for twenty-four hours and then laid in the ditch beside the road and kept covered with damp sand until it was time to dispatch them to the laboratory for crushing. There was little loss of time in sending these cylinders to Toronto for

Table No. 2.—Results of Breaking Test Cylinders.

Strength after 7 days				Strength after 28 days	
2,900 lbs.	2,800 lbs.	2,810 lbs.	4,330 lbs.	3,200 lbs.	2,800 lbs.
2,710 "	2,870 "	2,868 "	3,780 "	3,310 "	4,300 "
2,720 "	4,260 "	3,310 "	3,420 "	2,850 "	3,300 "
4,650 "	3,300 "	4,280 "	3,720 "	2,940 "	3,600 "
4,060 "	2,920 "	3,110 "	4,180 "	2,500 "	
3,290 "	3,210 "	4,140 "	3,190 "	3,140 "	
3,120 "	3,869 "	4,260 "	3,320 "	2,750 "	
4,150 "	3,080 "	4,340 "	3,320 "	3,860 "	
3,480 "	3,960 "	3,250 "		3,000 "	
2,800 "	3,090 "	3,610 "	Min. 2,710 "	3,660 "	Min. 2,500 "

crushing, as they usually were forwarded by truck one day and were crushed the next. The cylinders were largely broken at seven days and what the writer believes to be a standard formula was used in obtaining from this result the twenty-eight-day strength, i.e., 28-day strength = 7-day strength + $\sqrt{7\text{-day strength}}$. Cylinders were occasionally broken at twenty-eight days as a check on this formula, and the results are given in table No. 2. Calcium chloride admixture of 1½ pound per bag of cement gave strengths of about 2,200 pounds in three days. As the pavement laid was a rural one and was laid nine feet in width on one side of the centre line of the road, calcium chloride admixture was used at farm entrances, thus enabling the farmer to drive over the green concrete with light loads after three days, obviating the expense of building light bridges.

While results may check fairly accurately down to the point where the cylinders were tested, there is no guarantee that the cylinders had not been cured better than the pavement. If this is the case, then the results obtained are not a guarantee that the pavement is of the strength shown by the cylinders, and there does not seem to be any method short of the use of a coring machine which would prove the strength of the concrete in the finished pavement. The strengths obtained from the test cylinders given above, while they are not as uniform as might be desired, show a fairly satisfactory minimum considering the quality of the materials and the saving effected by the elimination of freight charges and the use of local material.

Discussion of Paper on Protection Against Seepage at Lake Kenogami, by O. O. Lefebvre, M.E.I.C.*

Mr. O. O. Lefebvre, m.e.i.c.

The author, in presenting the paper, remarked that in deciding the economical height to which the water could be raised in lake Kenogami, the governing factor was the topography around the lake, and not the water supply, because, as built, the reservoir could only hold slightly less than half the available amount of water, and elevation 115 could not be exceeded, the low water of the lake being 83 feet. Beyond that, level 115, the cost of dyking across ravines and creeks would have been altogether beyond the benefits to be derived from the additional water to be stored.

It so happened that in locating this contour 115, it was found that numerous dykes had to be built, but at one particular point,—at the " head of the lake,"—no dykes or other work had been provided because it had been thought that none would be necessary. At this point the lake Kenogami watershed is separated from the lake St. John watershed by a bank of sand of a minimum width of about 600 feet and a maximum of about 1,300 to 1,400 feet. Lake St. John lies approximately twenty miles in a northly direction from this point and is practically 290 feet below lake Kenogami. This sand bank, which it was thought would be sufficient to hold water when raised to a higher elevation, proved otherwise, and in 1924, when the lake was raised 10 feet, it was found that seepage was taking place through the sand bank and that it would be far from safe when it would be called upon to hold back an additional 13 feet of water.

The work to be done to prevent the seepage constituted quite a problem. If an impervious bottom had been found, it would have been rather easy, because an earth dyke with a core wall would have sufficed, but a boring carried 64 feet below the level of lake Kenogami showed nothing but sand. The method finally adopted really amounted to widening the sand bank of lake Kenogami.

Figure No. 1 of the author's original paper showed a topographical plan of the western end of lake Kenogami, and indicated the bank separating lake Kenogami from the lake St. John watershed. From the head of the ravine, the water flowed into lake St. John. the head of the ravine being at about elevation 70, as compared with lake Kenogami, which, in 1924, was at elevation 102, having been raised ten feet over its previous high water level of 92. Seepage was then noticed all round the bank and water was flowing down to lake St. John. Seepage was also detected as far down as lake Toussaint, which was found to have risen a few feet, and the same for lake Martel, while lake Louis had risen about a foot. A scheme was adopted of separating the bay from lake Kenogami, and the ravine, at *B-C*, was also filled. The width of the bank thus formed was such that water going through would have its velocity reduced to such an extent that there would be no danger whatever of any material being carried away. Many borings through the bank showed the hydraulic gradient to be about one foot in thirty feet, and the additional fill was designed on that basis, the idea being that the hydraulic gradient would lie always within or underneath the surface of the fill. The estimated amount of material required was about one million cubic yards.

Immediately the sand bank was completed, the water in the bay, separated from lake Kenogami, drained off from elevation 102 to about 95. It ran practically dry, which showed that below it the material was exceedingly pervious; in fact, it was more pervious than the sand bank built from material on the shore, and, of course, this gave further confidence in the proposed scheme.

In following the progress of the penetration of the water through the bank it was found that at the end of May the level of the lake had risen considerably, while the level in the bay had not changed. But in the next two months a very gradual movement of the water took place through the bank while the level of the lake was practically constant. Water was actually seen seeping through the surface of the bank.

The hydraulic gradient in the bank was then about forty to one. The bank was begun at a slope of thirty to one, but, while the machinery was there, it was thought that additional yardage would be advisable and less expensive than if it had to be done later. The slope was therefore changed to forty to one, and the yardage was increased in the two fills by one million cubic yards, the total yardage being two million cubic yards. The work was done by two

* This paper was presented at the Annual General Professional Meeting of The Institute, Quebec, February 16th, 1927, and published in the Engineering Journal, March, 1927.

methods, steam shovelling and hydraulic sluicing. Work was started in the fall of 1924, and the steam shovels were ready to work in October, and worked steadily day and night until the fill was completed in the month of July 1925. The coal for the steam shovels had to be hauled a distance of eleven miles, although much of it was hauled from the Chicoutimi end of the lake, which is connected to rail. The electric power for the sluicing machinery was transmitted especially for that job from the town of Jonquiere, a distance of twenty-one miles. The transmission line cost in the neighbourhood of $30,000. It had a capacity of 1,200 h.p. and the voltage was 33,000.

Sluicing practically commenced in the spring, although it was actually started in the latter part of November, but it was not practicable to use that system in winter. The progress of the work was very rapid. For example, in the month of April the monitors sluiced about 350,000 cubic yards, and, in the month of May, nearly as much. They had two monitors, each connected to two pumps, each pump driven by one 200-h.p. motor. The water was taken from the lake and delivered to the monitors at eighty pounds pressure through 16-inch pipes, and was pumped quite a long distance. All the material sluiced was very fine sand, and it was found that this material would sluice properly in a slope of about two and one-half per cent. The monitors had five-inch nozzles.

The cost of this sluicing was very much lower than the cost of the steam shovel work, if taken from day to day, but, on the whole, the two systems competed with one another. Some material was encountered which could not be moved by sluicing, such as material that was heavy or sand in which there was a lot of stone or gravel.

Mr. T. H. Hogg, M.E.I.C.

Mr. Hogg enquired if it was the case that part of the work was handled by shovels, while the monitors were used for washing the material into place.

Mr. O. O. Lefebvre, M.E.I.C.

The author replied that the two systems were completely separated; in fact, the steam shovels worked from one side and the monitors worked from the other side of the bank. The monitors actually sluiced the material into the bank from the pit.

Mr. T. H. Hogg, M.E.I.C.

Mr. Hogg asked whether any of the fill from the shovels had been placed on trestles or were the fills built out with end dump-cars.

Mr. O. O. Lefebvre, M.E.I.C.

The author replied that end dump-cars had been used.

Brig.-Gen. C. H. Mitchell, M.E.I.C.

General Mitchell asked for information as to the changes in level of lakes Louis, Martel and Toussaint after the completion of the work.

Mr. O. O. Lefebvre, M.E.I.C.

The author replied that when lake Kenogami stood at an elevation of 102 in 1924 the seepage was measured in the creek at lake Louis, and the discharge of the lake was found to be 23 cubic feet per second, and it was estimated that practically 100 per cent of that was due to seepage. This was the case with the lake level at 102. After the fill was completed and the lake level was raised to 115, and maintained there for a month, the seepage was again measured, and it was reduced to seventeen cubic feet per second, which amount could not be stopped.

The level of lakes Toussaint and Martel dropped two and a half feet. These two lakes. peculiarly enough, had no visible outlet; apparently they discharged through the ground, and, with existing conditions, with lake Kenogami standing at 115, these lakes had a level about 2.4 feet lower than their level when lake Kenogami was 102, previous to the completion of this work.

It appeared that the whole bank, which was pervious, was quite saturated, and, as the level of lake Kenogami rose, the saturation increased. He believed that if the level stood at 115 for twelve months the saturation might be different, but fortunately that was not necessary.

Mr. E. A. Forward, M.E.I.C.

Mr. Forward enquired as to the loss of water storage caused by putting in the dam and cutting out the end of the lake.

Mr. O. O. Lefebvre, M.E.I.C.

The author replied that the loss of storage was negligible.

Discussion of Paper on Rack Structure and Penstock Intake of the Isle Maligne Hydro-Electric Power Station, by W. S. Lee, M.E.I.C.*

Mr. W. S. Lee, M.E.I.C.

The author, in presenting the paper, remarked that it gave a general outline of some of the novel features in connection with the intake structure at the Isle Maligne power station.

Engineers were not given to breaking away from precedent, but in view of the rigid conditions which confronted them in the province of Quebec special study had to be given. They had the low temperature problem to deal with and the effect of these low temperatures on large structures. Contraction and expansion, handling ice, etc., had been very carefully considered.

On referring to figure No. 1, which is a typical section through the Isle Maligne station, it would be noted that a moveable crane traversed the entire length of the bulkhead. At the end of the power house, where a railroad car could be put under it, this crane could pick up any size load up to 60 tons, hoist it about 80 feet and traverse the entire

* This paper was presented at the Annual General Professional Meeting of The Institute, Quebec, February 17th, 1927, and was published in the Engineering Journal, January, 1927.

length of the bulkhead. This design had worked well, and the cost of the crane had been saved in erection. All of the large gates had been erected from the top of the bulkhead with this gantry crane.

They had deviated somewhat from Canadian practice in not having any intake building or housing over the bulkhead. In analyzing possible ice troubles, they had reached the conclusion that there would not be any frazil ice at all, since the water was impounded from Isle Maligne up to lake St. John, a distance of seven miles, and the nearest river of any size was probably twenty-five miles from the intake. Slush ice which came down the river stopped in the lake, and did not get to the power house on account of the quiet water. As yet there had not been any ice trouble.

Again referring to figure No. 1, near the top of the bulkhead to the right, where the gate stems go up, a tunnel could be seen, marked "elevation 258.9." This tunnel, running the entire length of the bulkhead, was put in there as an air duct. By this means the bulkhead was warmed by air from the generator room, and a continuous current of warm air was led into every gate chamber in the whole bulkhead. In this way there was a column of air rising over the opening to the gate stems, and the gates were warmed so as to operate irrespective of outside temperature. The arrangement worked automatically, and a study of it could be recommended.

The gates could be operated from the switchboard in case of emergency, as there was an emergency switch on the benchboard in the power house, so that the pivoted gate could be closed under full head and full gate opening of the water wheels; the importance of keeping the gates clear of ice was therefore obvious.

While discussing temperature conditions, the author referred to the question of ventilating the generator room. On the downstream side, windows had been provided in the basement. The governors were located in the basement near the servo-motors; the operators for the wheels were down there, and there were quite large windows along the entire length. If it were necessary to open these windows in extremely cold weather, admitting too much cold air, a temperature might result which would freeze the oil or small working parts of the governor. It would be noticed that the railroad track ran on two concrete beams the entire length of the power house, and, along and between the railroad track, gratings had been provided to allow the air to recirculate. By controlling the windows and gratings, any temperature desired could be maintained in the generating room. He considered that in large structures such as the Isle Maligne station it was very desirable, on account of contraction and expansion, to subject them to as little temperature variation as possible during construction. This was especially true when after completion they had a temperature regulating effect due to heat generated in the power house.

The work of excavating foundations for the Isle Maligne station began in May, and the structure was completed by December. When the weather began to get cold in the late fall the draught tube entrances were boarded up and covered with tar paper; salamanders were placed in the draught tubes, and this kept the temperature fairly uniform until the excavation of the tailrace was completed and the water admitted. By this arrangement the temperature variation of the whole structure had only undergone comparatively slight changes.

Number six unit in the station was turned over under its own water nine months after the commencement of excavation for the foundation. The short time consumed in the construction of the Isle Maligne plant necessitated the job being very heavily rigged, and more work had been done on designing the construction equipment and layout than on the power plant.

In dealing with the various drains and expansion joint seepages going down through the section into the draught tubes, these had to be drained under water to keep them from piling up ice at their outlets.

The pivoted gates were operated with one stem each by a motor controlled from the switchboard. Each gate weighed 54 tons, was 16 by 22 feet and was assembled complete at the shops.

Mr. W. G. Chace, m.e.i.c.

Mr. Chace enquired as to the rack velocities.

Mr. W. S. Lee, m.e.i.c.

The author replied that the rack velocities on about 90 per cent load were from 2.4 to 3 feet per second, depending on the variation in head. The discharge velocity in the tailrace would be about 4 feet per second.

Mr. J. A. McCrory, m.e.i.c.

Mr. McCrory had observed that the Isle Maligne racks were fixed in place, which he believed was rather an unusual practice for a large plant in that region. In operating one of the Shawinigan Company's plants, not unfavourably situated as regards the formation of frazil in the winter before the ice sheet formed, they still did get frazil after a stretch of very severe weather, and it had been necessary at times to lift the racks to take care of this condition for the few days during which it lasted. He would ask whether there had been difficulty at Isle Maligne with the formation of frazil on the racks, and, if so, how it had been dealt with.

Mr. W. S. Lee, m.e.i.c.

The author stated regarding the fixed racks that at Isle Maligne the Shawinigan conditions did not exist; they had a reservoir of water extending miles back before reaching any turbulent or frazil-forming water. He was aware that on a sheet of water a certain amount of frazil would be formed with the water almost quiescent. It was the intention always to fill up lake St. John in the fall or the summer, when the racks would be submerged about 20 feet, and the area would be so great at the entrance to the penstock that there would be practically no velocity that could carry down any frazil that would form on top of the water. Such an arrangement would not be suitable for a partially open stream, but was adapted to existing conditions in the north channel of the river, which was 700 to 800 feet wide and 80 to 90 feet deep, so that the velocity was low. He would point out that all the frames of the racks and concrete structures were fixed; the rack bars themselves were not, but were in slots with a keeper on top.

Mr. W. G. Chace, m.e.i.c.

Mr. Chace remarked that water velocities were a great deal more important than was generally believed by theorists. In 1911, when the Winnipeg plant was built, it was expected that it would take many years to build up the load. They sold 20,000 h.p., which was the initial installation, in about two or three years; the present installed capacity was 95,000 h.p. and they had recently bought 30,000 h.p., which total load had been developed in municipal service since 1911 in a city of about 200,000 population. Their canal was originally designed for one-half to two-thirds capacity, expecting that, as the plant developed, a further capital expenditure would be made, but this has not yet been done, and, in consequence, in a canal 1,000 feet long, they had a loss under full load of one and one-half feet, and they had, therefore, a velocity in the canal which tended constantly to break up the sheet of ice which formed over the surface. This occurred especially with the " kick-off " of load, when the whole sheet would break up and come down to the power house; some of that ice a month later could still be seen inside the rack rooms.

The racks were under shelter, and in recent years the hot air from the generator room had been turned into the rack room by means of fans, which made it possible to work comfortably there. The rack velocities at the Winnipeg plant were much lower than Mr. Lee had chosen for his Isle Maligne plant; the average velocity being about one and one-half feet per second; and still the ice and floating timber was driven against the racks and required constant attention. The racks were built in removable sections. He believed that as yet there had been no occasion to remove any sections except for maintenance purposes. Their low velocities were obtained by using an inclined rack some 45 feet in length from top to bottom, and over the entire entrance, so that the water did not enter the bays until after it had passed the racks; in other words, it was passed from unit to unit behind the rack, which had been found to be a very desirable condition.

He desired to ask the author for further information regarding the seal used against the butterfly gate and shown in figure No. 5 as a spring bronze leaf. That leaf, he supposed, had but little flexibility in a longitudinal direction. He enquired whether that had been found a satisfactory type of seal. The problem of sealing the gates had occurred at the Winnipeg plant and had not been met successfully originally, and as yet there had not been devised a means of keeping the gates sealed satisfactorily at the edges.

Mr. W. S. Lee, M.E.I.C.

The author was inclined to think that Mr. Chace's difficulty in bringing the debris and ice was not rack velocity, but canal velocity, since there was a rack velocity of one and one-half feet per second, and a much higher one in the canal. No such trouble had occurred at Isle Maligne, where the power house was placed across one channel of the river and the approach velocities were very low.

The seal to which Mr. Chace referred was of bronze and was tightened by water pressure when the gate was raised. A heavy angle sticking out to protect it from any pieces of ice which might bend it should have been shown in the drawing. He had been in the Isle Maligne penstocks while the gates were under head, and did not believe that enough water was leaking through the gate to fill a two-inch pipe.

Mr. F. Newell, M.E.I.C.

Mr. Newell was somewhat diffident in contributing to the discussion, but felt that a short description of the manufacturing work on the butterfly type head gates might be of interest.

The necessity for first class workmanship and the best modern machine shop practice had been realized by all concerned at the outset, and every effort was made to produce a gate that would be thoroughly watertight with a minimum of fitting and adjusting in assembly at the site. The centre castings were first turned accurately to diameter on the trunnion and then planed exactly parallel and true with the finished trunnion. Care was also take to plane the cast iron leaves so that they were both parallel and square, particular accuracy being looked for in the faces mating with the centre casting and also the faces on which the head of the shrink links took their bearing, as it would be seen that the length of the shrink links depended upon the accuracy of six machined faces and their parallelism when assembled.

In the interest of economical production, it was necessary that the links be machined to an exact predetermined length, so that any link could be shrunk into any place on the valves without having to make each link for a special location. That this had been accomplished was evidenced by the fact that the wings and centre casting when bolted together did not vary more than a few thousandths of an inch from parallelism and the nominal drawing dimension. The links were all machined 3/32 of an inch shorter than this dimension, and then shrunk into place after the wings were assembled with the centre casting.

The links being 3 feet 9 inches between the heads, 1/1,000 of an inch shrinkage per inch of length would give a stress of 30,000 pounds per square inch, but the higher shrinkage allowed was intended to take care of the compression taking place on the four pairs of mating surfaces, the compression of the metal itself and the elongation of the link. The links were made of a low carbon steel having an ultimate strength of 50,000 to 60,000 pounds per square inch and an elongation of 20 per cent, with a reduction of area of 40 per cent.

The trunnions, as mentioned by the author, were bushed with phosphor bronze, and the bearings were also fitted with a cast iron liner, so as to permit of easy replacement in case of wear of either part. In order to provide a free-running bearing, a clearance of 1/16 inch had been allowed between the bushing and liner, but, as oil lubrication was provided for from the operating machinery floor and the whole of this clearance would come into the cap and allow the oil to flow freely out of the bearing without lubricating it, it was decided to line the cap with close-fitting babbit strips which could be brought down on the trunnion and would retain the oil for lubricating purposes in pockets formed between these strips.

The centre castings, gate wings, bearings and frames were all completely assembled in the shop; all joints were reamed for fitted bolts; the spring seals fitted in place; and all pieces match-marked and then taken apart for shipment, in order to facilitate accurate assembly in the field.

On account of the heavy weight of the assembled valve, it had been necessary to do the shop assembly at a convenient height, and over railway tracks, so that flat cars could be run under, and the piece taken away to be handled by a large capacity yard crane for shipment on specially constructed well cars; the pieces being placed so that the centre casting was vertical and in the middle of the car.

The spring seals which Mr. Chace had mentioned were of the type which had been used on a number of head gates, and if care were taken in the shop and in the field these seals could be made absolutely watertight. There were many instances in which they were practically watertight, the only leakage being in the corners, where leakage would occur in any seal.

The spring seals had been made of triple leaf spring bronze, and as it was considered that with the gate just cracked open these seals would have to withstand the full hydrostatic head and at the same time must be flexible enough to take up any deflection in the gate leaf, a good deal of care was taken with their design and construction. Before determining their size and proportions, particulars were obtained of the elastic limit, ultimate strength and Young's modulus of the material used. Also, the springs were formed in dies so as to maintain an exact uniformity of shape, and a great deal of care was exercised in the works to construct the dies so that the correct final form was obtained.

He mentioned this because it had been found that when the springs were first made up in dies they always sprung back a little out of shape, and it was therefore necessary to try various forms to find exactly what shape the dies should be in order to produce the shape of spring which was finally used on the job.

Two points in connection with the screw-stem hoists were worthy of mention, although they were questions of design rather than workmanship. These were the limit switches and push button contacts provided so that the gates could, if necessary, be operated from the power house floor, and also the spring buffer devices on the closing side, arranged so that the motor would be brought to rest without impact to the machinery should the limit switch for any reason fail to act. The machinery, of course, had been designed to withstand the full torque of the motor determined from the setting of the overload coil on the circuit breaker.

Mr. T. H. Hogg, m.e.i.c.

Mr. Hogg remarked that the rack structure at Isle Maligne was of special interest, and the advantage of shipping with the rack bars removed was important from the point of view of economy of fabrication. He noted, however, that the framework holding the rack bars was embedded in the concrete and the racks could not be removed without unwatering with the stop-logs. It was also apparently necessary to take out each bar separately. This type of fixed rack structure had to be designed to withstand full hydrostatic head with the penstock empty, and the openings through the racks clogged so as to guard against the possibility of failure of the racks, as such failure would require shutting down the unit to effect repairs.

It has been the practice of the Hydro-Electric Power Commission of Ontario to design racks in panels of convenient size for handling with a follower and to install them in checks similar to those provided for stop-logs or steel gate sections. This obviated the necessity of designing the racks for full hydrostatic pressure, thereby effecting a considerable saving in steel and guarding against shut-downs. Any damaged panels could be removed and replaced with spares without shutting down the unit. It also enabled the removal of the racks for the passage of slush or frazil ice in case they should become clogged and the flow through the bars restricted.

He noted further that by-passes had been provided for filling the penstock before opening the butterfly gates. These were installed possibly for the purpose of protecting the bronze spring leaf water seal on the gate frame and to prevent chattering in the gate. Such provision was seldom required where head gates of the Stoney roller type were used. The butterfly gate possessed the advantage of requiring a relatively light motor for its operation compared with that necessary for the Stoney type of gate, but the latter type had a distinct advantage in that it could be closed in case of emergency in a few seconds, the butterfly type referred to by the author apparently requiring about five minutes.

It would be of interest to know whether the air tunnel underneath the headworks deck, for providing air to the penstocks in case of a sudden closure of the gates and to allow the escape of air when filling the penstocks, was continuous throughout the length of the head works, whether it was confined to each individual unit or whether partial barriers were provided between units in order to prevent water surging up from one unit to another which might be unwatered and under repair or inspection. The author had stated that warm air was supplied to the air vent and to the space beneath the head works deck through the opening near the roof of the circuit-breaker and transformer room. This would necessitate the warm air passing down into the air tunnel and across through the opening to the space benear the roof of the circuit breaker and transformer room. to be rather difficult to induce, and it would be of interest to know if fans or other means of forcing the air into these passages had been provided or if variation in the load on the unit were relied on to cause the necessary movement.

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Annual General and General Professional Meeting—1928

At the meeting of Council on April 22nd, a request was received from the Montreal Branch that the Annual General and General Professional Meeting of The Institute for the year 1928 be held in Montreal, which suggestion was approved by Council. Subsequently, the Montreal Branch appointed a special committee to take charge of arrangements in connection with the Annual Meeting. At the meeting of Council on May 20th, there was presented a report prepared by this committee suggesting that the Annual General Professional Meeting be held on February 14th, 15th and 16th, 1928, and, as this report was adopted, these dates are tentatively fixed for the meeting of next year.

It was further resolved at the last meeting of Council that the Annual General Meeting be convened on the evening of the third Thursday in January for the transaction of formal business, and that this meeting be adjourned to the date set for the holding of the Annual General Professional Meeting.

It may seem to many members an early date to be making arrangements for a meeting which is to be held in February of next year, but it has been found by experience that in order to procure papers of general interest and of a quality in keeping with such a meeting, and in order that these papers may be distributed in advance of the meeting so that a thorough discussion may be presented, it is by no means too early to attend to the preliminary details.

The success of the technical sessions at the last Annual Meeting was largely due to the excellent discussions of the various technical papers which were presented, and much favourable comment has been made regarding this feature of the programme.

It is the aim of the committee to make the 1928 meeting one to be long remembered, and to this end no effort will be spared in the preparation of the details of the programme in order that every member of The Institute may find much of interest at the meeting.

Amendments to By-laws

The result of the ballot for the amendments to the By-laws of The Institute was contained in a report of the scrutineers presented to Council at its meeting on May twentieth, nineteen hundred and twenty-seven, which showed that both changes were approved by a large majority of the members of The Institute whose ballots were cast, and accordingly these changes have now become effective. The amended sections of the By-laws are as follows:—

Section 13.—A vacancy in the office of president shall be filled by the senior vice-president. Seniority shall be determined by priority of election as a vice-president, and, failing that, by priority of admission to corporate membership.

Section 38.—The secretary shall notify any member whose fees become in arrears. No member shall be considered in arrears for any year until after the thirty-first day of March of that year. On the first day of January next following, six per cent per annum shall be added as interest on the subscriptions in arrears, and the same sum shall be added on the first day of January of each year until the said arrears are paid. No member who is in arrears after June thirtieth shall have the right to vote. Council may take action in the case of a member who is in arrears by:—

(*a*) Directing that he shall not receive the publications of The Institute and/or

(*b*) Removing his name from the register of members.

It will be recalled that these amendments were drawn up by the Committee on Legislation and By-laws, and subsequently approved by Council and presented for discussion at the Annual General Meeting on February fifteenth, nineteen hundred and twenty-seven, and then submitted by letter ballot to the corporate membership, the result of which is announced above.

Honorary Degree Conferred on President Decary

An impressive and interesting ceremony took place when the degree of Doctor of Applied Science, *honoris causa,* was conferred by the University of Montreal on the President of The Engineering Institute of Canada, Albert R.

Decary, M.E.I.C., on April 30th, 1927, at the Cercle Universitaire de Montreal.

There were present on this occasion Mgr. A. V. J. Piette, rector of the university; the Hon. Sir Lomer Gouin, president of the university; the Hon. L. J. Perron, one of the governors of the university, and a large gathering of graduates in engineering of the Ecole Polytechnique of Montreal, together with the students of the graduating class of the school, in whose honour a banquet was being given by the older graduates.

It will be recalled that the granting of this Honorary Degree to Mr. Decary was announced in the April 1927 issue of the Journal, shortly after the announcement of his election to the presidency of The Institute, and it will be most gratifying to members of The Institute to note that, in the extract of the minutes of a special meeting of the Corporation of the Ecole Polytechnique, held on February 21st, 1927, which was read by Dr. Augustin Frigon, A.M.E.I.C., director of Ecole Polytechnique at the commencement of the ceremony, the resolution granting the degree referred first to his recent election as president of The Institute and to the fact that he has been president of the Corporation of Professional Engineers of the Province of Quebec since its formation. It also referred to his being an old pupil of the Ecole Polytechnique, the importance of his position as superintending engineer for the province of Quebec of the Department of Public Works of Canada, and the great honour he has done to his Alma Mater and his profession.

In his address, Mgr. A. V. J. Piette, as rector of the University of Montreal, praised Mr. Decary for his successful achievements in his profession and referred at length to the high esteem with which he is held. He then asked the Honourable Sir Lomer Gouin, as president of the university, to present the degree to Mr. Decary. Sir Lomer spoke in high terms of Mr. Decary, and expressed his pleasure in being present to take part in the ceremony and especially in having the honour of presenting the degree to his friend, the new Doctor of Science. In a brief address, Dr. Decary, dressed with ermine toga, expressed his thanks to the university of Montreal and the Ecole Polytechnique for the honour bestowed upon him.

At the banquet following the ceremony, the president of the graduating class, Mr. S. Picard, presided, while among those at the head table were: Mgr. A. V. J. Piette, Sir Lomer Gouin, the Hon. Mr. L. J. Perron, Mr. C. J. Simard, assistant provincial secretary, Dr. A. R. Decary, M.E.I.C., Dr. J. Emile Vanier, A.M.E.I.C., to whom the degree of Doctor of Applied Science was also granted, Mr. U. P. Boucher, A.M.E.I.C., president of the Alumni Society of the Ecole Polytechnique, Dr. Arthur Surveyer, M.E.I.C., Dr. A. Frigon, A.M.E.I.C., Mr. Aurelien Boyer, A.M.E.I.C., principal of Ecole Polytechnique.

Empire Mining and Metallurgical Congress

The Second (Triennial) Empire Mining and Metallurgical Congress will be held in Canada from August 22nd to September 28th, 1927. During that time two simultaneous tours, in special trains, will be made of the Dominion of Canada. Tour "A" will visit the principal mining centres of Ontario, Quebec and western Canada. Tour "B" will travel through Ontario with Tour "A," and then examine the mining areas of Quebec, eastern Canada and Newfoundland. Meetings and technical sessions will be held in the following cities:—

Montreal, Que. ....August 22nd and 23rd.
Toronto, Ont. .....August 25th and 26th.
Winnipeg, Man. ...September 3rd and 4th.
Sydney, N.S. ......September 9th and 10th.
Vancouver, B.C. ...September 14th.
Edmonton, Alta. ...September 20th.

It has been decided to extend to fifteen members of The Engineering Institute of Canada the privilege of reserving space on these trans-Canada tours, and such reservations should be made as early as possible through the general secretary of the Congress, Geo. C. Mackenzie, M.E.I.C., 623 Drummond Building, Montreal, from whom further information can be obtained.

Meeting of Council

MEETING OF MAY 20TH, 1927.

A meeting of Council was held at eight o'clock p.m. on Friday, May 20th, 1927, President A. R. Decary, M.E.I.C., in the chair, and seven other members of Council being present.

The financial statement to April 30th was submitted and approved.

The recommendations of the Finance Committee in connection with eight special cases were considered and approved.

The report of the scrutineers on the letter ballot closing April 25th, 1927, for amendments to By-laws was submitted and accepted, and the amendments voted upon for Sections 13 and 38 were declared carried.

A letter from the Peterborough Branch was considered, drawing attention to certain points in connection with the organization of The Institute, and these were referred for consideration at the Plenary Meeting of Council to be held in October.

The offer of the Canadian Institute of Mining and Metallurgy to hold fifteen reservations for members of The Engineering Institute on the special Congress Tour train was noted with appreciation.

A letter was presented from a corporate member remarking on the difficulty experienced by him in securing reliable information as to relative building costs in Canada, and suggesting that The Institute might be willing to investigate the situation with a view of furnishing through the medium of The Engineering Journal a set of index numbers for the Dominion of Canada, and providing a monthly or quarterly service. After consideration, the Secretary was directed to advise the member in question that funds are lacking to do this effectively, and therefore that it is at present impossible to comply with his request.

The lists of officers of the St. John and Edmonton Branches for the year 1927-28 were submitted and approved.

The personnel of the Gzowski Medal and Students' Prizes Committee for the year 1927 was submitted and approved.

Decisions were given in the cases of two requests for reinstatement.

The following elections and transfers were effected:—

Elections	
Members	2
Associate Members	8
Affiliate	1
Students	7

Transfers	
Associate Member to Member	3
Junior to Associate Member	4
Student to Associate Member	2
Student to Junior	1

Thirteen applications for admission and transfer were scrutinized and classified for the ballot returnable June 21st, 1927.

Ten special cases were considered in connection with applications for admission.

The Council rose at ten-thirty p.m.

Recent Graduates in Engineering

Congratulations are in order to the following Students and Juniors of The Institute who have recently completed their courses at the various universities.

University of Manitoba

Special Prize

Rigby, Charles Arthur,—Joseph Doupe Gold Medal in Civil Engineering.

Degree of B.Sc.

Akins, Ernest Joseph William, B.Sc., (Ci.), Winnipeg, Man.
Benditt, Harry, B.Sc., (El.), Winnipeg, Man.
Evans, Frank Lloyd, B.Sc., (Ci.), Winnipeg, Man.
Genik, Alexander Charles, B.Sc., (El.), Winnipeg, Man.
Ingimundson, Ingimundur Carl, B.Sc., (El.), Winnipeg, Man.
Kennedy, Leslie John, B.Sc., (Ci.), Winnipeg, Man.
Mackay, Leslie, B.Sc., (Ci.), Winnipeg, Man.
McDermid, George, B.Sc., (El.), Winnipeg, Man.
Payne, Harold, B.Sc., (Ci.), Winnipeg, Man.
Reid, William Paul, B.Sc., (El.), Winnipeg, Man.
Rigby, Charles Arthur, B.Sc., (Ci.), Winnipeg, Man.
Rowan, John William, B.Sc., (Ci.), Winnipeg, Man.
Rowe, Gordon William, B.Sc., (Ci.), Winnipeg, Man.
Sinclair, Archie B., B.Sc., (El.), Winnipeg, Man.
Treble, Harold Edison, B.Sc., (El.), Winnipeg, Man.

Queen's University

Medal in Applied Science

Culver, Don Newton,—Governor-General's Silver Medal in Applied Science.

Degree of B.Sc. (with honours)

Culver, Don Newton, B.Sc., (El.), Kingston, Ont.
Houlden, James Walter, B.Sc., (Me.), Hamilton, Ont.
Jenkinson, Hugh Cameron, B.Sc., (Me.), Niagara Falls, Ont.

Degree of B.Sc.

Adams, George Ronald, B.Sc., (Ci.), Kingston, Ont.
Davis, George Roland, B.Sc., (El.), Smith Falls, Ont.
Gathercole, John William, B.Sc., (Me.), Hamilton, Ont.
Howard, James P., B.Sc., (Ci.), Kingston, Ont.
Knapp, Allen Clifton, B.Sc., (Me.), Sydenham, Ont.
Orange, Frank Angel, B.Sc., (Me.), Sudbury, Ont.
Robinson, Jack Spriggs, B.Sc., (Me.), Kingston, Ont.

University of Toronto

Degree of B.A.Sc. (with honours)

Grundy, Ernest, B.A.Sc., (Ci.), Toronto, Ont.
Jones, John Hugh Mowbray, B.A.Sc., (Me.), Toronto, Ont.

Degree of B.A.Sc.

Barr, Frederick Gordon Fordyce, B.A.Sc., (Me.), Toronto, Ont.
Fox, John Halloway, B.A.Sc., (Ci.), Toronto, Ont.
Thompson, William Lennox, B.A.Sc., (Me.), Toronto, Ont.

Ecole Polytechnique of Montreal

Prize in Architecture

Dechêne, Theo Miville,—The Ernest Cormier Prize.
Burdett, Georges Henry,—The Ernest Cormier Prize.

Prize in Industrial Chemistry

Perrault, Lucien,—The Louis Bourgoin Prize.

Diploma in Civil Engineering

Burdett, Georges Henry, (Ci.), Montreal, Que.

Diploma in Civil Engineering and Degree of B.A.Sc.

Archambault, Ubald, B.A.Sc., (Ci.), Outremont, Que.
Dechêne, Theo Miville, B.A.Sc., (Ci.), Westmount, Que.
Gravel, Louis Philippe, B.A.Sc., (Ci.), Beauport, Que.

Diploma in Chemical Engineering (with honours)

Perrault, Lucien, (Chem.), Outremont, Que.

McGill University

Honours in the Graduating Class, Medals and Prizes

Beck, Robert George, Winnipeg, Man.,—Crosby Steam Gauge & Valve Company's Prize for Summer Essay; Babcock & Wilcox Scholarship; Honours in Mechanical Engineering.
Coleman, Charles Lester, Providence, R.I.,—Undergraduates' Society's Second Prize for Summer Essay; also Departmental Prize for Summer Essay; Dr. James Douglas Research Fellowship in Mining Engineering.
Fraser, Willard Bruce, Stellarton, N.S.—British Association Medal (Electrical Engineering); Montreal Light, Heat and Power Cons. Prize; Honours in Electrical Engineering.
Johnston, Harry Lloyd, Victoria, B.C.,—Departmental Prize for Summer Essay.
Killam, Donald Alexander, Weymouth, N.S.,—British Association Medal (Civil Engineering); Honours in Civil Engineering.
Petzold, Henry Paul, Westmount, Que.,—Babcock & Wilcox Scholarship; Honours in Mechanical Engineering; British Association Medal (Mechanical Engineering).
Phillips, John Bernard, Montreal, Que.—British Association Medal (Chemical Engineering); Undergraduates' Society's Second Prize for Summer Essay; Honours in Chemical Engineering.
Silver, Ralph Charles, Danville, Que.,—British Association Medal (Electrical Engineering); Montreal Light, Heat and Power Cons. Prize; Jenkins Bros. Limited Scholarship; Honours in Electrical Engineering.

Degree of M.Sc.

Greenberg, Harry, B.Sc., M.Sc., (Chem.), Montreal, Que.
Katz, Morris, B.Sc., M.Sc., (Chem.), Montreal, Que.
McCurdy, Lyall Radcliffe, B.Sc., M.Sc., New Glasgow, N.S.
White, Thomas Nash, B.Sc., M.Sc., (Physics and Mathematics), Montreal, Que.

Degree of B.Sc.

Bauman, Bert Eric Frederick, B.Sc., (Ci.), Buckingham, Que.
Beck, Robert George, B.Sc., (Me.), Winnipeg, Man.
Bennett, Arthur Joseph, B.Sc., (El.), Maniwaki, Que.
Blackmore, Cyril Leslie, B.Sc., (El.), St. John's, Nfld.
Coleman, Charles Lester, B.Sc., (Mi.), Providence, R.I.
Darling, Thomas Creighton, B.Sc., (El.), Montreal, Que.
DesBrisay, Aretas William Young, B.Sc., (El.), Petit Rocher, N.B.
Dewar, Kenneth McIntyre, B.Sc., (Mi.), Dewar Lake, Sask.
Evans, Thomas Owen, B.Sc., (El.), Montreal, Que.
Fraser, Willard Bruce, B.Sc., (El.), Stellarton, N.S.
Gregory, Hurd Anthony Forbes, B.Sc., (El.), Fredericton, N.B.
Hamel, Joseph Albert, B.Sc., (Ci.), Three Rivers, Que.
Hicks, Ben Church, B.Sc., (El.), Bridgetown, N.S.
Johnson, Edward Lawrence, B.Sc., (El.), Welland, Ont.
Johnston, Harry Lloyd, B.Sc., (Ci.), Victoria, B.C.
Keene, Thomas Ross, B.Sc., (El.), Montreal, Que.
Killam, Donald Alexander, B.Sc., (Ci.), Weymouth, N.S.
Kingston, George Harold, B.Sc., (El.), Prescott, Ont.
McClure, Lindley Wilberforce, B.Sc., (El.), Verdun, Que.
Moffatt, Thomas Stuart, B.Sc., (El.), Victoria, B.C.
Moore, Lewis Nicholas, B.Sc., (El.), Ottawa, Ont.
Moore, William Herbert, B.Sc., (El.), Westmount, Que.
Mules, Nathan Ernest, B.Sc., (Chem.), Montreal, Que.
Petzold, Henry Paul, B.Sc., (Mech.), Westmount, Que.
Phillips, John Bernard, B.Sc., (Chem.), Montreal, Que.
Silver, Ralph Charles, B.Sc., (El.), Danville, Que.
Stewart, John Rufus, B.Sc., (Mech.), Beebe, Que.
Stewart, Leslie Baxter, B.Sc., (El.), Antigonish, N.S.
Villella, Frank R., B.Sc., (Ci.), Montreal, Que.
Wise, Alfred J., B.Sc., (El.), Rosemount, Que.
Yuile, William S., B.Sc., (Met.), Montreal, Que.

University of Alberta

Special Prize and Degree of B.Sc. (with honours)

Hunter, Harry Melville, B.Sc., (Mi.), Calgary, Alta.,—Prize of the Association of Professional Engineers of Alberta.

Dalhousie University

Diploma in Engineering

Armstrong, Owen Fred. Calder, Tupperville, N.S.

University of British Columbia

Special Prize

Millar, James Wallace,—The Convocation Prize (General Proficiency).

Degree of B.A.Sc.

Barnsley, Frank Richard, B.A.Sc., (El.), Vancouver, B.C.
Farrar, Ben Kerslake, B.A.Sc., (Met.), Vancouver, B.C.
Gale, Stanley Cuthbert, B.A.Sc., (El.), Vancouver, B.C.
Gordon, Arthur Illingworth Elmsly, B.A.Sc., (Ci.), Vancouver, B.C.
Millar, James Wallace, B.A.Sc., (Me.), Field, B.C.
North, John Terry, B.A.Sc., (El.), Vancouver, B.C.
Oliver, John Craig, B.A.Sc., (Ci.), Vancouver, B.C.
Todd, Robert Lawrie, B.A.Sc., (Ci.), Vancouver, B.C.
Wainman, Philip Richard, B.A.Sc., (El.), Vernon, B.C.

ELECTIONS AND TRANSFERS

At the meeting of Council held on May 20th, the following elections and transfers were effected:—

Members

O'HARA, George Dennis, B.Sc., (Princeton), consulting engineer, Vancouver, B.C.

SMITH, George Barnett, B.Sc., (McGill Univ.), i/c central Ont. system of H.E.P.C., Belleville, Ont.

Associate Members

CARRUTHERS, James Alexander, master mech. and ch. engr., C.P.R. mines, Lethbridge, Alta.

HANNAN, Ralph D., Ph.B. in C.E., (Yale), Dom. Bridge Co. Ltd., Montreal, Que.

MacKAY, James Arthur, B.Sc., (N. S. Tech. Coll.), asst. engr. with C.N.R., Bedford, N.S.

MANOCK, Wilbur R., B.S. in C.E., (Univ. of Ill.), mgr. of operations, Horton Steel Works, Bridgeburg, Ont.

McMURTRY, Lawrence Carleton, B.A.Sc., (Univ. of Toronto), supt. of erection Horton Steel Works, Bridgeburg, Ont.

PAINE, Nathan Deane, B.Sc., (New Hampshire Univ.), Price Brothers & Co. Ltd., Kenogami, Que.

PATERSON, E. L., B.A.Sc., (Univ. of Toronto), Imperial Oil Limited, Hamilton, Ont.

PORTUGAIS, Joseph Maurice, B.A.Sc., (Univ. of Montreal), tech. engr., Canada Cement Company, Montreal, Que.

Affiliate

ROSS, Robert Bruce, Ont. mgr. Milton Hersey Co. Ltd., London, Ont.

Transferred from class of Associate Member to that of Member

FINLAYSON, Ernest Herbert, B.Sc., (Univ. of Toronto), Director of Forestry, Forest Service, Ottawa, Ont.

RYAN, Edward A., B.Sc., (McGill Univ.), consulting engr., Montreal, Que.

SHARPE, D. Neville, C.E., (Univ. of Toronto), supt. of laying operations, Lock Joint Pipe Co., Washington, D.C.

Transferred from class of Junior to that of Associate Member

BAYNE, Blair Edmonston, with C.N.R., Moncton, N.B.

LAWSON, William John, B.Sc., (Univ. of N.B.), locating engr. Highway Constrn. Dept. of P. W., Fredericton, N.B.

McKILLOP, Vernon Archibald, B.A.Sc., (Univ. of Toronto), engr. Public Utilities Comm'n., London, Ont.

SIMPSON, Bruce Napier, B.A.Sc., (Univ. of Toronto), engrg. sec., hydraulic dept., H.E.P.C., Toronto, Ont.

Transferred from class of Student to that of Associate Member

BYRAM, Arthur Tennyson, B.A.Sc., (Univ. of Toronto), asst. engr. Dept. of Health, Toronto, Ont.

WIGGS, Gordon Lorne, B.Sc., (McGill Univ.), mgr. engrg. dept., Mechanics Supply Co. Ltd., Quebec, Que.

Transferred from class of Student to that of Junior

McLAREN, Leo G., B.A., (Laval Univ.), B.Sc., (McGill Univ.), Shawinigan Engrg. Co., Hebertville, Que.

OBITUARIES

Archibald William Campbell, M.E.I.C.

In the death of Archibald William Campbell, M.E.I.C., which occurred at his home in Ottawa on May 9th, 1927, Canada has lost one of its outstanding public men and one who has done a great deal for the advancement of the highway systems in Canada, and particularly in the province of Ontario. Through his long and enthusiastic service in the interests of highway development, the late Mr. Campbell was known throughout the country as "Good Roads" Campbell.

At the time of his death, Mr. Campbell was in his sixty-fourth year and was commissioner of highways for the federal government. He was born at Wardsville, Ont., on May 14th, 1863, and received his early education at the high school at St. Thomas, Ont. His first engineering experience was secured as a student in the office of James A. Bell, M.E.I.C., with whom he served for three years. Part of his earlier work was in connection with surveys on the Essex Centre and Welland Branch of the Canada Southern Railway.

In April 1885 he was commissioned an Ontario Land Surveyor, following which he engaged in private practice as civil engineer and provincial land surveyor. In 1888 he became associated with James A. Bell, M.E.I.C., under the firm name of Bell and Campbell, and was engaged in general engineering work, specializing in drainage systems, water works and bridges. On May 1st, 1891, he was appointed city engineer of St. Thomas, which position he held until 1896, when he was appointed good roads commissioner for the province of Ontario. Four years later he became deputy minister of public works with the federal government and in 1910 deputy minister of railways and canals in the federal government and later commissioner of highways for the Dominion government.

When, following the war, the Dominion government decided to appropriate $20,000,000 to subsidize the construction of a Dominion-wide system of main and market roads and interprovincial highways, Mr. Campbell was placed in executive control to administer the Canada Highways Act and supervise the carrying out of its provisions. In the organization of his work he was called upon to study the conditions in the different provinces of Canada and to devise a uniform classification of roads and to organize the necessary field and office staff. In connection with that work, he conferred with the various provincial highway departments as to the best methods of improving the roads of each province, and in due course prepared standard specifications for the several classes of highway contemplated by the federal act.

Mr. Campbell's technical training made his services of special value to the provincial highway departments in the consideration of the economic value of the road materials available in the various provinces, their transport and utilization. He was called upon to furnish, from time to time, technical advice based on the best engineering practice relating to road matters, and, in that connection, during his tenure of office, he prepared and issued, in addition to the annual reports of his branch, a number of circulars and bulletins containing a great deal of useful information on matters of road construction and motor transport.

The late Mr. Campbell joined The Institute as an Associate Member on March 22nd, 1888, and was transferred to Member on June 18th, 1896.

Joseph Lovitt Wilson, A.M.E.I.C.

News of the untimely death of Joseph Lovitt Wilson, A.M.E.I.C., has been received with profound regret by his many friends in the engineering profession as well as those in other walks of life.

The late Mr. Wilson was engaged on engineering work in Mexico, and, while in the field, without any thought of his own safety, he rescued one of his rodmen from drowning in one of the numerous deep water ditches. As a result of his experience, he contracted fever and was confined to the hospital in Mexico City for six months until the time of his death on March 16th, 1927.

Mr. Wilson was born at Bridgewater, N.S., on October 6th, 1880, and, after completing his primary education, he entered Dalhousie University at Halifax, N.S., from which he received the degree of B.Sc. in 1900. Immediately following graduation he joined the staff of the provincial engineer of Nova Scotia at Halifax, N.S., where he remained during the balance of that year, and in the following two years he was on railway work with the Nova Scotia Eastern Railway and Halifax and South Western Railway. In December 1902 he again joined the staff of the provincial engineer, where he remained until 1904, after which he returned to railway work and was engaged on surveys in the Maritime provinces and Ontario until 1913, when for a short period he was with the Cedar Rapids Manufacturing and Power Company on power line work in Quebec. During the following years he was first with the Montreal Tramways Company and later on maintenance work for the Canadian Northern Railway in New Brunswick. In May 1923 he was appointed resident engineer on the power development construction for the Puebla Tramways Light and Power Company, Orizaba, Mexico.

The late Mr. Wilson joined The Institute as Student on April 10th, 1902, and was transferred to Associate Member on October 9th, 1909.

Needham Everett Waddell

News of the death of Needham Everett Waddell, son of J. A. L. Waddell, M.E.I.C., of New York, which occurred on April 29th, 1927, has been received with deep regret.

The late Mr. Waddell was born at Tokyo, Japan, on June 21st, 1884. He came to America with his parents in 1886 and spent the early years of his life at Kansas City, Mo., attending several schools there. He was sent later to St. Paul's school at Concord, N.H., where he prepared for college. He elected to go to Rensselaer Polytechnic Institute, from which school he graduated with the class of 1908. For some years he worked in various capacities to obtain engineering experience. With McClintic-Marshall Company he helped build the Armour-Swift-Burlington bridge over the Missouri river at Kansas City. He served for a time with the Grand Trunk Railway Company of Canada, reporting concerning bridges on that company's lines located in the United States. For a while he worked in the employ of Waddell and Harrington on general bridge work, and later with his father. He was greatly interested in the construction of the highway bridge over the Missouri river at Lexington, Mo., designed by his father and erected by the state. He was the contractor's engineer on both superstructure and substructure. Later he entered the employ of the Foundation Company, with whom he remained until his death.

Mr. Waddell joined The Institute, in the days of The Canadian Society of Civil Engineers, as a Student on October 8th, 1908; transferred to Associate Member on October 14th, 1913, and to Member on April 23rd, 1918.

PERSONALS

C. M. Goodrich, M.E.I.C., has been appointed chief engineer of the Canadian Bridge Company, Limited. Mr. Goodrich was formerly designing engineer of the company. He entered the service of this company in the fall of 1901, where he has remained ever since.

W. D. MacKinnon, S.E.I.C., has been appointed to the engineering staff of the Donnacona Paper Company, Donnacona, Que. Mr. MacKinnon graduated from Queen's University in mechanical engineering in 1925, and was subsequently with the Bailey Meter Company, Limited, in Montreal.

A. L. Ford, M.E.I.C., district chief engineer with the Dominion Water Power and Reclamation Service, Calgary, Alta., has been appointed acting associate superintendent of Rocky Mountains Park at Banff, Alta. Mr. Ford is a graduate of the University of Toronto, from which he received the degree of B.A.Sc. in 1905.

S. E. McGorman, M.E.I.C., whose appointment as contracting engineer of the Canadian Bridge Company, Limited, has been announced, was formerly sales engineer with this company. He is a graduate of the School of Practical Science, University of Toronto, of the year 1905, and during the war he represented the Canadian Bridge Company in connection with its war work and its relation with the Imperial Munitions Board of the United States Ordnance Department.

Frank B. Thompson, S.E.I.C., who for the past four years has been on the staff of the Engineering Journal, first as assistant at Headquarters and later as Toronto representative of the Journal, has resigned to accept a position with B. L. Smith, of Toronto, publishers' representatives. Prior to joining The Institute, Mr. Thompson was in the draughting department of Messrs. Sproatt and Rolph, architects, Toronto, and at the same time was completing a course of studies in architecture and structural design.

FRANK B. THOMPSON, S.E.I.C.

P. T. Davies, M.E.I.C., commercial manager of the Southern Canada Power Company, Limited, was elected president of the Electrical Club of Montreal at their recent annual meeting. At this same meeting, Fraser S. Keith, M.E.I.C., was elected first vice-president and H. M. Lyster, A.M.E.I.C., was re-elected secretary-treasurer.

William E. Walsh, Jr.E.I.C., who up until April 1926 was designing engineer with the Preston Woodworking Machinery Company, Preston, Ont., and during the past year designing engineer with the Mechanical Manufacturing Company, Chicago, Ill., is now with the Illinois Tool Works, Chicago, Ill., in the capacity of research engineer.

H. C. Lott, A.M.E.I.C., who is located in London, England, has left on a three or four months trip to Kenya Colony in connection with hydro-electric developments there. Mr. Lott was born and educated in the Old Country, but was for a number of years engaged on engineering works in Canada. His present mailing address is 66 Queen Street, London, E.C. 4.

A. G. Moore, S.E.I.C., has joined the engineering staff of the Bell Telephone Company of Canada at Montreal and will be engaged on transmission work in the eastern division of the company. Mr. Moore graduated from the Nova Scotia Technical College in 1925, and since graduation has been located in Wilkinsburg, Pa., with the Canadian Westinghouse Company on their students' test course.

Charles A. Mullen, M.E.I.C., director of the paving department of the Milton Hersey Company, Limited, Montreal, has been appointed vice-president and managing director of the newly formed company known as Milton Hersey Ontario Limited. In addition to his new duties, Mr. Mullen will continue his former work and practice as an independent consulting paving engineer.

D. N. Culver, S.E.I.C., of Orillia, Ont., who graduated with honours from Queen's University this year, was the recipient of the Governor-General's Medal in Science, which is awarded to the science student with the highest standing in all subjects for the third and fourth years. Mr. Culver is at present with the Canadian General Electric Company and is located at Peterborough, Ont.

A. E. West, A.M.E.I.C., formerly manager of construction of the Canadian Bridge Company, Limited, has been appointed operating manager of the company. His connection with this company dates back to January 1911, and during this time he has occupied various positions, including squad foreman, chief draughtsman and manager of construction.

Geo. F. Porter, M.E.I.C., LL.D., formerly chief engineer of the Canadian Bridge Company, Limited, has been appointed consulting engineer of the company. Mr. Porter's first connection with this company dates from its organization in 1900. He was awarded the Gzowski Medal of The Institute in 1919 with G. H. Duggan, M.E.I.C., and the late Phelps Johnson, M.E.I.C., for a paper entitled "The Design, Manufacture and Erection of the Superstructure of the Quebec Bridge."

F. H. Kester, M.E.I.C., formerly contracting engineer of the Canadian Bridge Company, Limited, Walkerville, Ont., has been elected a director and vice-president of the company. Mr. Kester was born at Richland, Mich., in 1885. His early education was received at the high school at Richland and his engineering education at the University of Wisconsin. He joined the staff of the Canadian Bridge Company as draughtsman in 1907 and served in various engineering capacities until 1919, when he was appointed to the position from which he has now been promoted.

Harold S. Weldon, Jr.E.I.C., for the past two years District manager of the Montreal office of the Canadian Inspection and Testing Company, Limited, has been appointed assistant to the general mechanical superintendent of the Dominion Textile Company, Limited, Montreal. Mr. Weldon graduated from the University of Toronto in 1922 with the degree of B.A.Sc. He had commenced his university course prior to the outbreak of the war, but due to his service overseas he was unable to complete it until 1922. During the summer of 1921 he was with the Canadian Inspection and Testing Company at Toronto, and upon graduation he returned to that office as engineer in charge of electrical tests.

J. M. Portugais, A.M.E.I.C., has joined the staff of the Canada Cement Company, Limited, as technical engineer, his field of work comprising principally the province of Quebec, together with a portion of eastern Ontario and the Maritime provinces. He was born at Rimouski, Que., and after receiving his primary education at Rimouski College and Levis College he entered the University of Montreal, receiving his degree of B.A.Sc. in civil engineering in 1924. He later returned to the same university for post-graduate work in electricity, receiving the degree of E.E. His practical experience includes work with the Quebec Streams Commission; Department of Public Works, Quebec; Shawinigan Engineering Company; Southern Canada Power Company, and the water board of the city of Montreal.

E. Blake Allan, A.M.E.I.C., Appointed Town Manager

E. Blake Allan, A.M.E.I.C., formerly on the staff of the Department of Civil Engineering of the University of Toronto, has been appointed town manager of Woodstock, N.B., succeeding M. J. Rutledge, M.E.I.C., who recently resigned.

Mr. Allan is a native of Nova Scotia and is a graduate of the University of Toronto, from which he received the degree of B.A.Sc. in civil engineering in 1916. He is also a former student of Dalhousie University, where he spent two years in the engineering course. In consideration of a thesis on the construction of sheet asphalt pavement, the University of Toronto conferred upon him the professional degree of C.E.

Prior to entering the university, Mr. Allan had two years experience in railroad construction. The year 1913 was spent as assistant to the town engineer of Yorkton, Sask., while for six months during 1914 he was engaged on an extensive drainage scheme at Cobalt, Ont. Following his return from overseas, where he served as an officer in the Imperial Army from 1916 to 1919, he was engaged for thirteen months on general construction work with the Laurentide Company of Grand'Mere, Que., and from 1920 to 1926 he was engaged in municipal work under the city engineer of Hamilton, Ont.

J. Harold Wallis, A.M.E.I.C., Receives Appointment

J. Harold Wallis, A.M.E.I.C., has been appointed manager of purchasing for the Ste. Anne Paper Company, Limited, at Quebec city. Mr. Wallis, who is a native of California, has been engaged on engineering work in Canada since 1909, his early work being land surveys, railway surveys and construction. In August 1914 he enlisted for overseas service as a private with the British Expeditionary Force, and throughout the war served overseas with distinction. In July 1915 he received his commission as Lieutenant and in 1916 that of Captain and in the following year that of Major.

Following his return to civilian life in 1919, Mr. Wallis entered the service of the Canadian Pacific Railway Company on maintenance-of-way on the Bowmanville division. In June 1920 he was appointed assistant engineer with the Department of Railways in connection with the Grand Trunk arbitration, and later in that year joined the engineering staff of the Canada Creosoting Company in Toronto. Subsequently, he was appointed supply engineer with the Riordon Pulp Corporation, Limited, at Temiskaming, Que., and, following the acquisition of this company by the Canadian International Paper Company, he was transferred to the construction department in charge of the purchase of equipment and materials for the extension to the mill.

Recent Appointments by Montreal Harbour Commissioners

T. W. Harvie, M.E.I.C., general manager of the port of Montreal, has been appointed general manager and secretary of the port, the two positions having recently been merged. Mr. Harvie is a native of Scotland, and on coming to Canada was appointed resident engineer on the construction of various works in the port of Montreal. In 1913 he became assistant chief engineer of the Harbour Commissioners and in 1922 chief engineer, which position he held until his appointment as general manager.

T. W. HARVIE, M.E.I.C.

Alexander Ferguson, M.E.I.C., of the Department of Railways and Canals, Ottawa, has been appointed to the office of assistant general manager of the port of Montreal, which position was recently created by the Harbour Commissioners. Mr. Ferguson is a native of Scotland, and after serving his apprenticeship in Glasgow engaged in various engineering works. He came to Canada in 1905, joining the engineering staff of the National Transcontinental Railway, with which he remained in various capacities for a number of years, finally occupying the position of divisional engineer at Quebec. In 1914 he entered the federal service of the Department of Railways and Canals at Ottawa, and occupied the position of general assistant engineer at the time of his recent appointment.

J. W. Seens, A.M.E.I.C., Appointed President and General Manager of Canadian Bridge Company

J. W. Seens, A.M.E.I.C., has been appointed president and general manager of the Canadian Bridge Company, Limited, of Walkerville, Ont., succeeding L. A. Paddock, who has resigned.

Mr. Seens was formerly vice-president of the company. He was born at Cincinnati, Ohio, on November 8th, 1881, and received his early education at the high school at Grand Rapids, Mich., later entering the department of civil engineering of the University of Michigan, from which he graduated with the degree of B.S. in 1901.

Immediately following graduation, Mr. Seens joined the staff of the Canadian Bridge Company, Limited, as draughtsman, but in October 1905 returned to Grand Rapids, Mich., where he was engaged on engineering work with the city engineer. In February 1906 he returned to Canada, and once more entered the employ of the Canadian Bridge Company. In 1911 he was appointed manager of the Structural Steel Company, Limited, Montreal, and in 1918 he was appointed by the Canadian Bridge Company manager of sales with headquarters at Montreal. Since that date he has remained with this company, and in 1920 took out naturalization papers of Canadian citizenship. He was elected a director of the company in 1922 and vice-president in 1926. He is also a director and president of the Essex Terminal Railway.

J. W. SEENS, A.M.E.I.C.

New Maps Issued

The Topographical Survey of Canada, Department of the Interior, Ottawa, has recently issued a map known as the Sussex Sheet of the National Topographic Series, on the scale of one mile to the inch. This map, which includes an area of about four hundred square miles lying between latitudes 45°45′ and longitudes 66°0′, covers part of Kings, Queens and Saint John counties in the province of New Brunswick, although the major portion is comprised of the Kings county.

The Topographical Survey of Canada has also issued the Touchwood Sheet of the Sectional Map of Canada, which is on the scale of three miles to the inch. This sheet covers the area in townships 25 to 32, ranges 16 to 29 inclusive, west of the second meridian.

BOOK REVIEWS

Hydro-Electric Handbook

By William P. Creager and Joel D. Justin, John Wiley & Sons, Inc., New York. Leather, 6 x 9¼ in., 897 pp., illus., diagrams, $8.00.

In their preface the authors state that the book aims to present a compendium of all phases of modern hydro-electric practice; that it is designed to contain sufficient descriptive matter to make it valuable to the student, and that it includes the latest ideas in theory and practice, making it of considerable interest to practising engineers.

The task to which they set themselves is large, but they have succeeded admirably and have produced a book of great value to the engineering profession. The material is well selected and is well arranged, and the insertion of duplicates of important curve sheets is a valuable feature. The best authorities have been freely canvassed by the authors to supplement their own knowledge of the subjects treated and a carefully compiled bibliography rounds out the book.

The first chapter on rainfall or precipitation gives a very complete outline of the scientific methods of collecting and using rainfall data, particularly as applied to the United States. It is followed by studies of evaporation and run-off and the methods of estimating stream flow, floods and the effect of artificial storage.

The important question of the capacity of a proposed development is viewed from many angles and a clear explanation is given of the terms, primary power, secondary power, demand factor, diversity factor and plant factor.

A very interesting chapter reviews the principles of hydraulics and contains a large number of formulæ and other useful data.

The design of the hydraulic side of the development is treated in a series of eighteen chapters which go into great detail and the most up-to-date methods are discussed.

The chapters on electrical designs contain a wealth of material, and while some of the calculations are necessarily abridged they are always suggestive and references are given which enable the reader to gain further information without loss of time.

Both authors and publishers are to be congratulated on the production of an excellent book.

C. V. Christie, M.E.I.C.

Professor of Electrical Engineering, McGill University, and Consulting Engineer, Montreal.

Proceedings of International Conference on Bituminous Coal, November 15-18, 1926.

Published by Carnegie Institute of Technology, Pittsburgh, Pa. Cloth, 6 x 9 in., 830 pp., illus., diagrams, tables, $7.00.

Every one interested in the subject of bituminous coal, its treatment and utilization, must be indebted to the Carnegie Institute of Technology for planning the International Conference on Bituminous Coal held in Pittsburgh last November.

The proceedings of the meeting held include papers from leading authorities in England, Germany, France, Japan and the United States, covering every phase of the subject, and form a complete and comprehensive review of the work done up to the present time by different investigators and men connected with related industries.

The scientist, the chemist and the engineer are all closely associated in the field of coal treatment and the recovery of valuable derivatives. Coal can no longer be considered merely as a fuel to be burned in its raw state, and especially is this the case in England and European countries, where necessity compels a husbanding of natural resources and the provision of chemical substitutes for petroleum products to a greater extent than is at present felt in Canada or the United States.

Few people realize the amount of research work that has been done and is being done, and the successful commercial applications of the results obtained, and an assembly of papers of the highest order such as are included in this one volume of the proceedings of the conference is of very great value.

It is impossible to make any attempt to review in a short space a large number of papers of such wide scope and variety, but mention should be made of the very interesting and valuable paper by Dr. Bergius on the "Transformation of Coal into Oil by Means of Hydrogenation." The liquefaction of coal and the manufacture of a synthetic motor fuel are of first importance to every one, and Germany has contributed largely to the attainment of these results.

The production of a smokeless fuel from bituminous coal for domestic use, with the recovery of valuable by-products, is also very timely and is treated in detail in a number of the papers, including descriptions of several commercial systems.

The particular appeal of each paper depends of course upon the interest of the reader in the subject covered, and a résumé of the subjects dealt with in the various papers will no doubt be appreciated by members of The Institute as indicating the scope and importance of the book.

The details of the papers, in addition to which there are also printed the discussions, are as follows:—

Our Coal Supply: Its Quantity, Quality and Distribution; British Research on Fuel Utilization; the Practical Value of Fundamental Research on Coal; the Transformation of Coal Into Oil by Means of Hydrogenation; the Industrial Transformation of Bituminous Coal Into Organic Technical Products; Methyl Alcohol as a Motor Fuel; Coal and Its Mineral Matter; National Supplies of Power; What Bituminous Coal is Doing for Itself and for the Nation; the Coming of the New Coal Age; the Synthesis of Petroleum; English Development in Carbonization of Coal in Gas Works; Some New Uses for Pulverized Coal; Powdered Coal for Power Purposes; Mouth of Mine Power Stations; the Relation of Thermal Storage in Boiler and Furnace to Fuel Application; Bituminous Coal as a Source of Chemical Products; the Instantaneous Carbonization of Crushed Coal; Utilization of Coal Tar Products; Coal Tar Disposal; the Recovery of Phenols from Steel Plant Fuel Tars; the Formation of Naphthalene During High Temperature Carbonization; Utilization of Bituminous Coal in the Manufacture of Water Gas; a Revolutionary Improvement in Gas Production; Possibilities of Fuel Economy in the Iron and Steel Industry; Coal in Relation to the Production of Fixed Nitrogen; Coal as a Source for Fertilizer; Economic Aspects of the Fertilizer Industry; the Relation of Coal to Fertilizer; the Economic Aspect of the Conversion of Coal Into Smokeless Fuel; Smokeless Fuel; the Smoke Problem of Cities; Fundamental Studies on Coal to Carbonization Problems; Development in Low Temperature Distillation of Coal at Fairmont, West Virginia; Distillation of Coal; Internal Heating; the L. & N. Process; the McEwen-Runge Process for the Low Temperature Distillation of Coal; the Greene-Laucks Process; the Piron Coal Distillation Process; the Low Temperature Distillation of Coal in Rotary Retorts; Low Temperature Carbonization of Coal; the Bussey Process of Low Temperature Distillation; the Cracking of Low Temperature Tars by the Dubbs Process; the Missing Link in Low Temperature Carbonization.

F. A. Combe, M.E.I.C.,

Consulting Engineer, Montreal.

EMPLOYMENT BUREAU

Situations Wanted

Civil Engineer

Open for an engagement about May 20th, M.E.I.C., returned soldier, twenty-five years experience in all parts of Canada and United States; railway location and construction, canals, concrete structures, sewers, water systems, buildings, highway location and construction, all classes of pavements; experience as engineer-in-charge and superintendent for contractor. Apply box No. 225-W, Engineering Journal.

Electrical Engineer

B.A.Sc., University of Toronto. Two years testing with large electrical company. Three years in engineering department on design of railway control apparatus. Desires new connection with firm located in central Ontario. Employed, but available on few weeks notice. Apply box No. 226-W, Engineering Journal.

Back Numbers of Journal

Requests have been received for various back numbers of The Engineering Journal of which the supply at Headquarters has been exhausted. If any member has copies of the issues mentioned below, the Secretary would appreciate receiving them at Headquarters. The issues wanted are:—March 1919, July 1920, and January and April 1921.

ABSTRACT OF PAPER

Long Span Bridges

Professor C. R. Young, M.E.I.C., Department of Civil Engineering, University of Toronto.

Kingston Branch, March 23rd, 1927.

Little progress in the development of long span arches in stone masonry has come about in the last five or six centuries. As early as 1377 A.D., when the Trezzo arch over the river Adda in Italy was built, with a span of 251 feet in the clear, the approximate limits of stone arch construction were reached. The longest span ever attained in this material is in the arch at Plauen, Saxony, with a clear span of 295 feet.

Metallic bridges were constructed first of cast iron. While unsuccessful attempts were made as early as 1755, it was not until 1776, when the Coalbrookdale arch over the Severn river, England, was built, with its span of 100.5 feet, that cast iron really was placed on a practicable basis for bridge construction. In 1795 the Sunderland bridge over the river Wear was erected with a single cast iron arch of 236 feet in span. The record appears to have been attained in the 240-foot central span of the Southwark bridge over the Thames, London, one of the elder Rennie's most notable works. Spans of 450 feet were proposed by Robert Stephenson for the Menai straits crossing, and Telford and Douglas actually designed a 600-foot cast iron arch for a bridge to replace London bridge, but no actual construction appears to have surpassed that attained in the Sunderland and Southwark bridges.

Forced by the rejection of his cast iron design for the Menai straits crossing, Robert Stephenson developed the tubular type of bridge and built at first the 400-foot span at Conway in 1848, and in 1850 the celebrated Britannia bridge containing two spans of 460 feet. While the Victoria tubular bridge, completed in 1860, was much more extensive in total length than any other bridges of the type previously constructed, none of its spans equalled in length the Conway and Britannia spans above noted.

Very early employment of the suspension principles for bridges in primitive materials is on record, and it is said that spans upwards of 600 feet have been attained by the use of twisted vine cables in China, India, Thibet, and South America. A very extensive use of the suspension principle grew up about the beginning of the 19th century and there are still numbers of these early bridges in existence. One of the most notable of the earlier bridges is the highway bridge built by Telford over the Menai straits in 1825. This had a central span of 580 feet. While Robert Stephenson had abandoned the idea of a suspension bridge for railway traffic over the Menai straits, basing his decision upon previous disappointments with the type, John A. Roebling completed, in 1855, the 821-foot span that has given the name " Suspension Bridge " to the Canadian National crossing of the Niagara gorge. By careful attention to stiffening devices, Roebling was able to construct a bridge that carried railway traffic successfully for 43 years. Soon after, he completed the Ohio river bridge at Cincinnati with a span of 1,057 feet, the first bridge to exceed 1,000 feet in span. The great Brooklyn bridge, with its span of 1,595.5 feet was Roebling's crowning achievement, although, unfortunately, he lost his life through an accident at the bridge site when the work was still in the foundation stage. While the Williamsburg bridge, with a span of 1,600 feet, and the Manhattan bridge, of 1,470 feet, both across the East river at New York, greatly exceeded in capacity the Brooklyn bridge, it must be conceded that the latter was, in view of the early date of its construction and the boldness exhibited therein, perhaps the most notable suspension bridge achievement on record.

The record for span in the suspension type rests with the bridge over the Delaware river between Philadelphia and Camden, with its 1,750-foot central span, only 50 feet less than that of the Quebec bridge. A striking departure was made in this structure by employing only two cables, these being each 30 inches in diameter and containing each 18,666 wires of 0.195-inch diameter. The speaker described at length the method of cable spinning and construction employed upon this great bridge.

While, so far, no every extensive employment of the eye-bar cable type has been made, there nevertheless is reason to believe that it will be employed more extensively in the future. For a considerable number of years the record for span was held by the Elizabeth bridge over the Danube at Budapest with its span of 951 feet. The record is now held by the Florianopolis bridge, Brazil, which has a central span of 1,114 feet. The cables of the latter structure are of special heat-treated steel, having a minimum ultimate strength of 105,000 pounds per square inch, and a minimum elastic limit of 75,000 pounds per square inch. One of the distinctive advantages of the eye-bar type involving the merging of the cables with the top chords of the stiffening trusses for approximately the centre half of the span, was utilized in this structure. By making the maximum depth of the stiffening trusses at about the quarter point and diminishing the depth therefrom towards mid-span and towards the towers, it was found that, as compared with the parallel chord type of trusses, supported from wire cables, the rigidity was increased four times while the weight of the stiffening trusses was reduced by a third.

Growing out of a number of failures of cast iron arches, it was generally conceded about the middle of last century that further long span arch construction in metals ought to be of either wrought iron or steel. The first notable arch bridge of this new order was the Eads bridge over the Mississippi river at St. Louis, having a central one of three spans 520 feet in length. The construction was carried out from 1868-1874. The chords of the latticed ribs of these arches were of chrome steel staves encased in an envelope of wrought iron. The type was original, but no bridge of any consequence has ever been built since according to this type. Three notable arches in steel have been built across the Niagara gorge, the upper one with a span of 840 feet, having held the record for length of arch span for nineteen years. It was replaced by the 977.5-foot span of the Hell Gate arch at New York city, a structure built of hard steel having an ultimate strength from 66,000 to 76,000 pounds per square inch. The 1,650-foot arch span now being constructed across the harbour of Sydney, Australia, very closely resembles in type the Hell Gate arch. In deciding upon a sudden increase in span limit of 69 per cent, the engineer of the latter structure has exhibited a good deal of boldness.

Trusses in metal are more modern than suspension bridges or arches. The first comparatively long span trusses are the two 455-foot spans of the Saltash bridge, built in 1859 by the younger Brunel. These trusses, as will be recalled, contain each a single elliptical tubular top chord with two eye-bar bottom chords. The limit of span for simple trusses is held by the Metropolis bridge at Metropolis, Ill., 1,720 feet in length, and employing in considerable measure silicon steel.

Continuous bridges, while adaptable to fairly long spans, have not been largely employed in America. The two 408-foot spans of the original Canadian Pacific Railway bridge across the St. Lawrence at Lachine, of course, no longer exist, and the only other notable continuous bridge in Canada is that over the Nelson river at Kettle rapids on the line of the Hudson Bay Railway. The extreme length of span hitherto attained by the type is in the Sciotoville, Ohio, bridge with its two 775-foot spans.

Professor Young expressed the view that having regard to all the circumstances, the Forth bridge is perhaps the most notable cantilever structure ever erected. Built between 1883-1890, it contains two spans of 1,710 feet, only 90 feet less than the central span of the Quebec bridge, which now holds the world's record for span length. The circumstances connected with the two accidents to the Quebec bridge were outlined and the causes explained. However disappointing the two failures were to the engineering profession, there must be a corresponding satisfaction in the successful surmounting of all obstacles and the final completion of the bridge almost wholly by Canadian effort.

Remarkable spans are being attained in reinforced concrete in France by the eminent engineer, M. Freyssinet. The 432-foot span of the St. Pierre du Vauvray arch, with its phenomenally thin box ribs, is the greatest span hitherto attained, but there will shortly be completed at Plougastel an arch having three spans of 590.5 feet each. The speaker described a number of projected bridges of great boldness, for example, the Hudson river bridge with a span of 3,500 feet, which seems likely to reach the construction stage shortly, and the projected bridge for the Golden Gate at San Francisco, with a span of 4,000 feet.

Milton Hersey Company, Limited, has announced the formation of a new company to be known as the Milton Hersey, Ontario, Limited, which will have charge of the design and technical control of asphalt paving work in Ontario which was heretofore done by the parent company, the experience and staff of which will be available to clients, the personnel remaining as in former years. The officers of the new company are:—Dr. Milton L. Hersey, president; Charles A. Mullen, M.E.I.C., vice-president; James G. Ross, vice-president; Robert B. Ross, manager; Roy Geddes, treasurer; Lew R. Hersey, secretary. The head office of the new company will be at London, Ont.

Recent Additions to the Library

Proceedings, Transactions, Etc.

PRESENTED BY THE SOCIETIES:
- Lake Superior Mining Institute, Report of 25th Annual Meeting, Volume 25, 1926.
- Institution of Engineers of Australia, Transactions, Volume 25, 1924.
- American Society for Testing Materials, Proceedings of 29th Annual Meeting, Volume 26, part 1-2, 1926.
- American Institute of Electrical Engineers, Year Book, 1927.
- The Society of Engineers, (England), Transactions, 1926.
- American Society of Mechanical Engineers, Year Book, 1927.
- Canadian Engineering Standards Association, Year Book, 1926.

Reports, Etc.

PRESENTED BY MINES BRANCH, DEPARTMENT OF MINES, CANADA:
- Investigation in Ceramics and Road Material, 1925, Report No. 672.
- Investigation in Ore Dressing and Metallurgy, 1925, Report No. 670.
- Investigation in Mineral Resources and Mining Industry, 1925, Report No. 669.
- Helium in Canada, by R. T. Elsworthy, Report No. 679.

PRESENTED BY THE AERONAUTICAL SOCIETY:
- Reports and Memoranda of the Aeronautical Research Committee.

PRESENTED BY THE DEPARTMENT OF MINES, ONTARIO:
- Hydro-electric Development for Metal Mines of North Ontario, by G. A. Webster, (Revised Edition), Bulletin 46.
- Preliminary Report on Mineral Production of Ontario in 1926.

PRESENTED BY THE DEPARTMENT OF MINES, QUEBEC:
- Geological Sketch and Economic Minerals of the Province of Quebec, by T. C. Denis, (French and English).

PRESENTED BY THE NATIONAL RESEARCH COUNCIL, CANADA:
- Nitrogen in Industry, 1926, J. C. McKenna, Bulletin 12.

PRESENTED BY THE CANADIAN GEOLOGICAL SURVEYS:
- Economic Geology Service. Iron Ores of Canada, Volume 1, British Columbia and Yukon, by G. A. Young and W. S. Uglow.
- Report, (Summary), 1925, part A-B.

PRESENTED BY DOMINION BUREAU OF STATISTICS, CANADA:
- Census of Industry. The Pulp and Paper Industry, 1925.
- Trade of Canada Fiscal Year, March 31st, 1926.

PRESENTED BY THE JOINT BOARD OF ENGINEERS:
- Report on the St. Lawrence Waterways Project, March 16th, 1926.

PRESENTED BY E. L. MILES, COUNTY ROADS SUPERINTENDENT:
- Annual Report of County Roads System, Victoria County, 1926.

PRESENTED BY THE DEPARTMENT OF THE INTERIOR, CANADA:
- Canada's Arctic Islands, Canadian Expeditions, 1922-26.
- Water Resources, Paper No. 56. (Dominion Water Power and Reclamation Service.)

PRESENTED BY THE ELECTRIC POWER COMMISSION OF NEW BRUNSWICK:
- Seventeenth Annual Report, 1925-26.

Technical Books

PRESENTED BY E. & F. N. SPON:
- Diesel Engines, (3rd ed.), by A. H. Goldingham.
- Aerial Cableways, by G. Ceretti.

PRESENTED BY JOHN WILEY & SONS:
- Hydro-electric Handbook, by W. P. Creager and J. D. Justin.
- Moveable Bridges: Volume 1, Superstructure; Volume 2, Machinery; by O. E. Hovey.

PRESENTED BY MCGRAW-HILL BOOK COMPANY:
- Solving Sewage Problems, by G. W. Fuller and J. R. McClintock.
- Water Works Handbook, by A. D. Flynn, R. S. Weston and C. L. Bogart.

Map of Weyburn and Vicinity

The Topographical Survey, Department of the Interior, Canada, has issued another sheet of the sectional map of Canada known as the Weyburn sheet No. 20, which includes townships 1 to 8, ranges 1 to 15 inclusive, west of the second meridian.

Annual Meeting of American Society for Testing Materials

A provisional programme for the annual meeting of the American Society for Testing Materials, which is to be held at French Lick Springs hotel, French Lick, Ind., June 20th to 24th, 1927, has just been issued. The tentative programme for the five days includes, in addition to the business sessions at which reports of the various sectional committees will be presented and discussed, recreation and entertainment during the meeting.

BRANCH NEWS

Border Cities Branch

C. G. R. Armstrong, A.M.E.I.C., Secretary-Treasurer.

THE MANUFACTURE OF MODERN NEWSPRINT

A regular meeting of the Border Cities Branch was held on the evening of Friday, April 22nd, in the Prince Edward hotel. T. L. Crossley, A.M.E.I.C., vice-president of the Industrial Laboratories, who is a member of the Professional Engineers of the Province of Ontario, and a special lecturer on pulp and paper at the University of Toronto, delivered an address on "The Manufacture of Modern Newsprint."

Mr. Crossley, in dealing with his subject, stated that Canada leads the world in this production, providing 45 per cent of the raw materials and actually manufacturing one-third of the newsprint of the world. He then described in detail the various steps in the process of manufacture from the logging operations to the final production of the paper.

In conclusion, Mr. Crossley again referred to the important place that Canada holds in the manufacture of newsprint paper, and whereas in 1890 the amount of export was $120.00, to-day it is $180,000,000.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, A.M.E.I.C., Branch News Editor.

JOINT MEETING WITH A.I.E.E.

There were about one hundred and ninety persons attended the annual joint meeting of the Hamilton Branch of the Engineering Institute of Canada with the Toronto section of the American Institute of Electrical Engineers, held in the Westinghouse auditorium on April 22nd. L. W. Gill, M.E.I.C., as chairman of the Hamilton Branch, called the meeting to order and then turned the meeting over to M. B. Hastings, chairman of the Toronto section, A.I.E.E. Mr. Hastings introduced the speaker of the evening, R. C. Bergvall, of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., who spoke on "A Mechanical Analogy to the Problem of Transmission Stability."

He showed a very ingenious model having two pivoted arms representing voltage at the sending and receiving ends of a transmission line. The ends of the arms were connected together by a spiral spring which represented the voltage drop in the line. This drop is taken to be entirely due to reactance, the resistance drop and capacity effects being neglected. "Load" was applied to the model by means of weights placed in a pan suspended from a pulley on a continuous cord which was wound in opposite directions around a pulley on each arm of the model, tending to rotate the arms in opposite directions.

As the load was increased the arms separated, the amount of separation depended on the strength of the spring and on the weight in the pan. The electrical analogy for this action is that as the load on the transmission line increases the phase angle between the generator and receiving ends of the line increases, the reactance drop increases. Load might be added until the arms are practically 90° apart, but if any more load was added and the arms pass the 90° position, the model would become unstable and the angle would increase until the arms hit the table or the supports. This condition represents the pulling apart of the two ends of a transmission line.

The effect of short circuits on a transmission could be very readily shown by means of the model and the oscillations resulting from short circuit conditions or from switching operations were very graphically reproduced. It was readily seen, from the model, that when a line is loaded nearly to the pull out point, very light disturbances will cause it to pull apart, but that if it is lightly loaded it will stand very much more severe disturbances and still regain a state of equilibrium.

A condenser at any point on the line was represented by a third revolving arm which did not have any provision for applying a load to it. This was connected to some intermediate point on the spring connecting the arms representing generator voltage and motor voltage. For a condenser of finite capacity, the connection between the condenser arms and the main spring was by an auxiliary spring representing the synchronous reactance of the condenser itself. With the condenser added, it was readily seen how the stability limit of a transmission line is increased.

The effect of parallel lines was readily shown by a second spring in parallel. This, as would be expected, increased the stability limit materially.

The speaker also showed lantern slides illustrating, by curves, the advantages of the high speed of response excitation system in maintaining voltage on the line under disturbing conditions, such as switching, short circuits, grounds, etc. The high speed of response excitation system is being used on the 25-cycle generators of the Gatineau Power Company, which will feed the 250-mile, 220,000-volt transmission line to the Hydro-Electric Power Commission of Ontario in Toronto.

Numerous questions were asked the speaker, after which a hearty vote of thanks was moved by H. C. Don Carlos, of the Toronto section, A.I.E.E., seconded by Hugh Lumsden, M.E.I.C., of the Hamilton Branch, which was carried with applause.

Mr. Gill made a few closing remarks expressing the appreciation of the meeting of the Canadian Westinghouse Company's kindness in arranging the meeting and in serving refreshments, to which Mr. Hart responded.

Executive Meeting

A meeting of the Executive Committee of the Hamilton Branch was held in the office of W. L. McFaul, M.E.I.C., on May 11th, at which six members of the executive were present.

Several recommendations to council regarding changes in the By-laws of The Institute were discussed and some resolutions were passed which are to be referred to the general secretary.

Some discussion resulted regarding another meeting this year, but it was felt that it was too late in the season to arrange one before the summer, and it was decided to hold an executive meeting early in September when an opening dinner-meeting for the next season would be arranged.

Kingston Branch

G. J. Smith, A.M.E.I.C., Secretary-Treasurer.

One of the largest meetings of the branch this year was held in Carruthers Hall, Queen's University, on the afternoon of March 23rd, to hear an address by Prof. C. R. Young, M.E.I.C., of the Department of Civil Engineering, University of Toronto, on "Long Span Bridges." Prof. L. T. Rutledge, M.E.I.C., chairman of the branch, occupied the chair, and the speaker was introduced by Prof. L. M. Arkley, M.E.I.C.

Professor Young sketched bridge history from early times down to the present and even went as far as the consideration of the future possibilities in bridges of long span. In his descriptions of numerous structures of different design and size, he had the details and masses of figures completely at his disposal. A splendid assortment of slides were shown, bringing out many of the salient features peculiar to the particular type of work.

The whole address proved very interesting and was found most instructive by the members of the branch as well as by the large number of engineering students present. An abstract of Prof. Young's address appears on another page of this issue.

At the close a vote of thanks was moved by Prof. A. Macphail, M.E.I.C., and seconded by Prof. W. L. Malcolm, M.E.I.C. The hearty response showed the audience's appreciation of the lecture

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

Manufacture and Uses of Carbon Dioxide

Attention was called to important developments in the functions and uses of carbon dioxide in an interesting paper delivered at a meeting of the branch on April 4th by J. R. Donald, A.M.E.I.C., consulting chemical engineer of J. T. Donald and Company, Limited.

In introducing the subject the speaker said that of the different gases met with in nature, apart from that of oxygen, there is none more closely identified with our daily life than carbon dioxide.

Until about the beginning of the twentieth century, when more economical processes became available, relatively pure carbon dioxide was obtained by either one of two methods: (1) by contact of sulphuric acid with carbonates, or (2) by heat applied to crushed magnesite or dolomite in closed retorts, both of which produce valuable by-products.

With the growth of the industry another method, known as the coke process, has been developed. In this process a volume of potassium carbonate operates through an absorption tower and a boiler. The carbon dioxide is absorbed from the flue gas passing through the absorption tower and carried to the boiler where it is released under the influence of heat on the bi-carbonate. The efficiency of this process is dependent upon the maximum utilization of heat available in the coke fire.

A more recent process is available in the various fermentation industries where large quantities of by-product carbon dioxide may be obtained economically. Due to contaminating odours, some method of purification is necessary. The most successful, known as the Backhaus process, is dependent upon the ability of activated carbon to absorb large quantities of any gas, and that independent of the amount of another gas already absorbed. In practice, therefore, the gas from the fermenters is passed through towers packed with activated carbon. The mass is quickly saturated with carbon dioxide which thereafter passes through, while the smaller percentage of impurities is retained. When the carbon is saturated with impurities, live steam is blown through the towers to drive them out. It may be said that the economical advantages of this method give promise that it will displace all other processes.

Once the carbon dioxide is collected in the gasometer it only remains to compress it into steel cylinders at approximately 1,000 pounds pressure. At this pressure, the gas at ordinary temperatures becomes liquified and it is thus possible to compress the maximum of gas into the cylinders.

Carbon dioxide has a wide variety of uses. By far the largest market exists in the beverage industry, where it is employed to impart "life" to the drink, improve its appearance and flavour, and give the well known sparkle. It also possesses a valuable preservative action by inhibiting the growth of certain bacteria, a property recognized in the preservation of shredded cocoanut, tobacco, coffee, butter and ice cream.

In refrigeration, due to its non-poisonous and non-irritating properties, it is adapted for use in ships, hotels, stores or other places where ammonia fumes are unpleasant. In the solid form it has the merit of producing fresh, pure dry gas at a low temperature without the formation of a liquid which recommends it for household use.

A new industrial field has recently opened up the development of the use of carbon dioxide for the purpose of fire extinction. Ordinary combustion is inhibited by the presence of 15 per cent of carbon dioxide in the atmosphere. Its use is limited, therefore, to confined areas where this dilution can be maintained. Due to the modification of the containing cylinders and the system of control, it is now possible to release the necessary volume of gas in a few seconds. This application is now finding extensive use in marine, mine, telephone, electrical and inflammable liquid fires, where the presence of the carbon dioxide cuts off the supply of oxygen necessary for combustion.

Other applications are as a source of pressure for clearing pipes, locating leaks, operating paint outfits, inflating tires and as an aid to artificial respiration, removable of boiler scale and the acceleration of plant growth. New uses are developed from time to time, and it seems probable that the next few years will see an increased demand and a consequent increase in its production.

The meeting was presided over by K. G. Cameron, A.M.E.I.C., and a vote of thanks tendered the speaker on the motion of Geo. R. MacLeod, M.E.I.C.

Vallee Street Substation

A distribution substation, which will, when completed, be the latest and largest installation of its type on record, was described at a meeting of the branch in a well illustrated paper on April 21st, 1927, by Humphreys Milliken, M.E.I.C., chief engineer of the electrical department, Montreal Light, Heat and Power Consolidated.

"The 60,000-k.v.a. ultimate capacity of the new substation and its location on Vallee street had been determined," the speaker stated, "after an extensive study of existing and probable future demands for electrical service in Montreal, and by a survey of recent developments in substation practice in American cities."

Following this study a comprehensive construction programme was provided to meet the growth of the city by anticipating the future requirements of each distribution area. The design finally adopted for the central area substation on Vallee street introduced many new and interesting features, principally intended to guard against the spread of operating troubles in so large a plant. These features and the details of design and equipment were fully described by the speaker.

The chairman of the meeting, C. V. Christie, M.E.I.C., presented to the speaker the hearty vote of thanks which was moved by K. B. Thornton, M.E.I.C., past vice-president of The Institute.

Presentation of Gzowski Medal and Students' Prizes

Preceding the paper, J. L. Busfield, M.E.I.C., in the absence of the president, Mr. Decary, and after a brief and commendatory biography of the donor, presented in fitting terms the highest award of The Institute, the "Gzowski Medal," to Lesslie R. Thomson, M.E.I.C., for his paper, "The Fuel Problem in Canada," and the Student Prizes of The Institute to R. G. Beck, S.E.I.C., and B. C. Hicks, S.E.I.C., for their papers on mechanical and electrical engineering subjects.

GATINEAU POWER DEVELOPMENT

An impressive description, beautifully illustrated, of the immense development which has transformed the basin of the Gatineau river in the past year, was given to the members of the branch at the last meeting of the season, April 28th, 1927, by Walter Blue, M.E.I.C., manager of the development department of the Gatineau Power Company.

In the case of the Gatineau river, the manufacture of paper and the development of power are closely associated, for without the power demand of the paper mill there would not be sufficient market available for economic development, and, conversely, without a power supply, it would not be feasible to operate the paper mill.

In quoting a very famous engineer, the speaker said: "As there are opportunities on practically every river for the development of the power placed there by nature, it remains only for man to study the river sufficiently in order to obtain the best solution."

The problem presented by this river has been partly solved by the building of a storage reservoir and three power plants and the proposal to build a fourth. These power plants have been so located that the headwater of one will be approximately the same level as the tailwater of the plant next above.

The plants have been located at Farmer rapids, Chelsea, Paugan falls and Maniwaki. Two units at Chelsea and one at Farmers are already supplying power to the paper mill, where the first unit commenced manufacturing paper last month. The four sites together will develop 370 feet of head in a total stretch of about 80 miles from Ottawa.

The power generated will be distributed as follows:—To the Hydro-Electric Power Commission, 260,000 h.p.; Canadian International Paper Company mill, for steam, 160,000 h.p.; for operation, 40,000 h.p.; Canada Cement Company, 3,000 h.p.

The storage dams at Bitobee, etc., creating the third largest artificial reservoir in the world, were closed on April 1st, and on the day of the meeting had already impounded twenty-five billion cubic feet of water or, approximately, one-quarter of the capacity of the reservoir.*

An interesting feature was the transportation of some 35,000 tons of material by tractors, including the steel hull of a tug weighing thirty-seven tons, which was successfully taken in by one tractor.

A transmission line has already been constructed connecting the Chelsea and Farmers rapids plants and the mill. This is a 110,000-volt line about six miles long. Other transmission lines necessary are: 110,000-volt line about twenty-six miles long from Farmers to Chelsea, to Paugan, and 220,000-volt line also about twenty-six miles long from Paugan to the Ottawa river, crossing near Quyon. This last named line will connect up with the lines of the Hydro-Electric Power Commission of Ontario.

The aerial photographs were found to be surprisingly accurate and greatly aided survey parties in anticipating topography ahead and locating camp sites for the storage survey.

Dr. Arthur Surveyer, M.E.I.C., past-president of The Institute, expressed the appreciation of the meeting, which was presided over by W. C. Adams, M.E.I.C.

* On May 21st the elevation of the water level of the Bitobee storage reservoir was 740.8, there having been stored 56.5 billion cubic feet of water. The reservoir when full will hold 95 billion cubic feet with the water level at elevation 755.

Niagara Peninsula Branch

Walter Jackson, M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

VISIT TO UPPER REACHES OF THE WELLAND SHIP CANAL

The spring outing of the branch, which was held on April 27th, was a trip along the upper reaches of the Welland ship canal followed by dinner and an illustrated address by the engineer-in-charge, A. J. Grant, M.E.I.C.

Members from all parts of the peninsula motored to the city of Welland and met about 2.00 p.m. at the headquarters of the Atlas Construction Company, which is building the large inverted syphon to convey the Welland river (sometimes known as Chippawa creek) under the bed of the new canal. Just at present the place presents the aspect of a veritable forest of steel sheet-piling, wooden piles and assembly trestlework, surrounding an excavation approximately 500 feet long, 200 feet wide and 40 to 80 feet deep.

Perhaps the layman will see little to interest him beyond the massive timbering, but an engineer finds features of unusual interest in the foundation work.

The structure, when finished, will consist of six concrete tubes, each 22 feet in diameter and 350 feet long, capable of handling the flood waters of the river, some 10,000 c.f.s., with a loss of about one foot of head. It is being constructed in open cut, in a reddish clay which, when wet, has all the consistency of a good thick soup. Foundation piling is of course carried some twenty feet further to rock but, with this exception, nothing is stable and the present canal carrying navigation adjacent to the east end does not improve the situation. Large circular cut-off cells of steel sheet-piling move two to four feet over night and have to be steadied by gravel backing. The occasional heavy fir strut or waling will crumple or snap like a twig under some intense local pressure and replacements are being made all the time, so that when the concrete is finally poured into another section a sigh of relief is heard.

The superintendent for the Atlas Construction Company, J. A. Grant, M.E.I.C., directed the party on its tour of the work and explained to them some of the difficulties. He appeared quite cheerful and would probably fight shy of anything solid like a rock cut if it was now offered to him.

The steamship A. M. German, with her namesake as master of ceremonies, ran alongside the work and the party embarked for their trip along the canal. First passing through the city of Welland, they then picked up stragglers at the Canadian Dredging Company's wharf, and about two miles further south came in sight of the new vertical lift bridge carrying the Canadian National Railway, Wabash division, over the canal. This bridge is the largest of its type in Canada. The erection has just been completed by the Canadian Bridge Company, but it is not yet in operation, although the lift span has been raised and lowered several times by means of the auxiliary gas engine. Of the twenty-one moveable bridges crossing the ship canal at various points, twelve are to be similar to this vertical lift bridge.

The next ports of call were the two suction dredges belonging to the Canadian Dredging Company, the Tornado and the Primrose. Both were busily engaged in widening and deepening the present canal to the ship canal width of 300 feet on the water line and 25 feet depth.

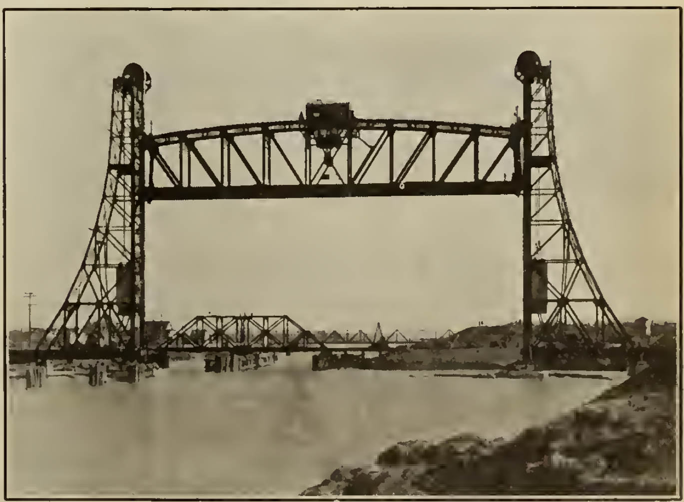
The Tornado impressed the visitors with her spick and span condition, having the advantage over the Primrose in that she was an oil burner. Her engines are directly connected to the large pump and she was gouging into the stiff clay at the rate of about 8,000 cubic yards per day. At the Primrose many of the party availed themselves of the low banks and, headed by the engineer-in-charge, Mr. Grant, scrambled along the pipe line to the discharge end at the spoil grounds.

The party returned to Welland at 6.15 p.m. and sat down to a real and satisfying dinner at the Hotel Dexter.

Right here might be a good place to intimate gently to the members that the secretary admits his secret formula for determining the number of table reservations has fallen down. An excess attendance of 60 per cent has proved it to be a complete failure. In this instance some forty-five members only signified their intention of being present and yet sixty-seven sat down to dinner.

After dinner Chairman Alex. Milne, A.M.E.I.C., formally introduced the speaker, Alex. J. Grant, M.E.I.C., engineer-in-charge of the Welland ship canal.

Mr. Grant gave a brief historical sketch of canal making in Canada starting with a lockless canal at Montreal, commenced by the Seminary of St. Sulpice in the year 1700 but never completed. Coming to the Welland ship canal, slides were presented showing graphically the progress of work up to date, traffic charts, labour and material costs. Then nearly a hundred photographs depicting



Welland Ship Canal—Bridge No. 17.

Vertical lift bridge carrying Canadian National Railways (Wabash Division). Clear span 200 ft., clear lift 122 ft., depth of truss 40 ft., weight of truss 580 tons, height of towers 177 ft.

every stage of the work from Port Weller harbour on lake Ontario to Port Colborne on lake Erie. Dry excavation, dredging, mass concrete work, revetments, wash walls, breakwaters, bridges and many other details.

The inverted syphon, visited in the afternoon, was further described, as well as an interesting method of underpinning an old abutment that was considered unsafe for the newer and heavier bridge loads. Pits were excavated under the toe and the old piles were one by one subjected to the pressure from a 100-ton hydraulic jack and driven to refusal. Extra batter piles, composed of short sections of steel tubing, were then driven in the same manner and filled with concrete.

Details were also shown of the reinforced concrete cribs for breakwaters at Port Colborne and for bridge substructures built in the wet, and in connection with the latter, an ingenious circular saw mounting for cutting the tops off piles at a depth of about thirty-five feet below the surface of the water. Records of pile cutting with this machine show 140 piles in three hours and 260 piles in ten hours.

At the conclusion of the address A. F. Fifield, A.M.E.I.C., moved that a very sincere vote of thanks be extended to Mr. Grant, and also to the Atlas Construction Company and the Canadian Dredging Company for their part in making the outing a success. This was seconded by H. L. Bucke, M.E.I.C., and heartily approved by the meeting.

ANNUAL MEETING—MAY 18TH

New officers:—

C. H. Scheman, M.E.I.C. .... Chairman.
E. G. Cameron, A.M.E.I.C. .... Vice-Chairman.
Walter Jackson, M.E.I.C. .... Secretary-Treasurer.

Executive:—

L. L. Gisborne, A.M.E.I.C. .... R. W. Downie, A.M.E.I.C.
R. H. Harcourt, A.M.E.I.C. .... C. G. Moon, A.M.E.I.C.
(*Ex-officio*), Alex. Milne, A.M.E.I.C. .... E. P. Johnson, A.M.E.I.C.

The annual meeting of the branch was held at the Welland Inn, St. Catharines. Somewhat of an innovation was introduced this year in that the ladies were invited to attend, and judging by the number present there must have prevailed a certain amount of forgivable curiosity as to just what these engineres do and how they conduct their meetings. Mr. and Mrs. Durley were both interested in the experiment, and Mr. Durley promised that on his return to Montreal he would report the matter to Council.

Dinner was interrupted and enlivened by frequent interludes of general sing-song and some extremely good solos were given by Mrs. Malley, of Welland, and S. R. Frost, A.M.E.I.C.

After dinner Mr. Durley gave a brief résumé of The Institute activities and discussed some of the problems which will be dealt with by Council when it meets in October.

The question of relations with the professional engineering associations in different provinces is quite pressing and some set standard of qualification for admission to all is highly desirable. The distribution of prizes is another matter for consideration, as is also the inauguration of better methods for stimulating and developing interest among the members of The Institute and its branches.

Principal Maurice Hutton, M.A., LL.D., of the University of Toronto, was the guest of honour and speaker of the evening. He took as his topic "Some Phases of Present Day Life in America," and dealt with it in a truly scholarly and classical manner tinged with a subtle irony and undercurrents of humour.

At the close of Principal Hutton's address a vote of thanks to the speaker and to Mr. Durley was moved by A. J. Grant, M.E.I.C., and seconded by S. R. Frost, A.M.E.I.C.

A vote of appreciation was also given to R. W. Downie, A.M.E.I.C., for his extremely good work during the last six years as secretary-treasurer of the branch.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held in St. Luke's hall on Friday, April 29th. Owing to the absence of G. H. Kohl, M.E.I.C., chairman, and R. S. McCormick, M.E.I.C., vice-chairman, C. H. Speer, M.E.I.C., took charge of the meeting. For the benefit of the visitors present, he outlined the history of The Engineering Institute of Canada and told how and why it was formed. He then introduced Mr. C. L. Richardson, radio engineer of the Canadian General Electric Company of Toronto, outlining briefly his career and war record, where he was intimately connected with the radio and electrical end of the war work.

Mr. Richardson gave an address on "Radio," which was well demonstrated with slides, showing the design and manufacture of different sets. A film entitled "The Wizardy of Wireless," was also shown in two parts. The first part covered the making of receiving sets and showed the flow or transmission of current through the coils. The second part was a continuation of the first and dealt with the receiving end of the radio and the transmission of the waves through the coils and tubes.

He outlined the early history of radio and the transmission of messages by various methods. The Hindoos and others used drums for this purpose, the Indians used the smoke signs and then followed the flag waving, the semaphore and the heliograph. He demonstrated various types of machines, from the simplest machine up to the present eight-tube machine and gave charts showing their range. He stressed the necessity of using high-power machines to get the best results, as he said more tubes gave more volume.

A hearty vote of thanks was tendered to Mr. Richardson by Mr. Fred Lambert, president of the Sault Radio Club, for his splendid address and was seconded by C. H. E. Rounthwaite, A.M.E.I.C., on behalf of the branch.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

The members of the Saint John Branch were addressed on April 21st by J. N. Flood, A.M.E.I.C., speaking on the subject "Engineering in Contracting." As a graduate engineer now engaged in the contracting business, the speaker mentioned many incidents from his own personal experience.

By means of charts the speaker showed the range of bids received on a number of typical jobs, the cost of work, day by day, against monthly progress payments giving an idea of capital required for financing, also the money totals of jobs bid on each year against contracts awarded to a firm, showing the immense amount of work in preparing bids not awarded to a firm. The speaker mentioned the method of calculating by cubic foot or square foot as a basis for approximate bidding, and that this method might also be used as a check on bids made up on the itemized unit price basis. Valuation of property, which is usually figured on its replacement value, was mentioned as one of the fields which contractors are now entering, due to the changing types of construction from residential and apartment to business and office buildings in growing cities.

FOREST FIRE PREVENTION

A feature of the evening was the co-operation of the branch in assisting the work of the Canada Forest Week. A short address on the necessity of forest fire protection was given by H. C. Kinghorn, B.S.F.

A. R. Crookshank, M.E.I.C., acted as chairman and extended a vote of thanks to the speakers of the evening, on motion of F. P. Vaughan, M.E.I.C., and A. Gray, M.E.I.C. The meeting was held in the New Brunswick Telephone Company building.

ANNUAL MEETING

The annual meeting of the Saint John Branch was held at the Admiral Beatty hotel on the evening of May 4th. The business portion of the evening was preceded by a very enjoyable banquet of which thirty-seven partook. Following the procedure adopted last year, only the junior members of the branch, who do not ordinarily take an active part in branch discussions, were chosen to speak on the toast list. The younger men acquitted themselves well and gained thereby additional practice so necessary for ease in public speaking.

The toast to the King was observed in silence. The toast to the City of Saint John was proposed by E. G. Grant, A.M.E.I.C., and replied to by Dr. W. W. White, mayor of Saint John. As the citizens of Saint John had voted on the previous day in favour of harbour nationalization, the remarks of His Worship were devoted largely to this subject and to the part engineers must play in the further development of this port. The toast to the Press was proposed by E. J. Owens, A.M.E.I.C., and replied to by F. X. Jennings, a guest representing the "Telegraph-Journal." F. M. Barnes, A.M.E.I.C., proposed the toast to The Engineering Institute of Canada, which was replied to by W. J. Forbes-Mitchell, M.E.I.C.

At the business session, which followed immediately after the toasts, the reports of the executive and of various branch committees were presented. The reports showed the business of the branch to have been carried on well during the past year, although, due to deaths and removals from branch district, there was a loss of nine members during the year.

J. H. McKinney, A.M.E.I.C., on behalf of the scrutineers, reported that the election of officers for 1927-28 resulted as follows:—chairman, S. R. Weston, M.E.I.C.; vice-chairman, E. A. Thomas, A.M.E.I.C.; members of executive, J. R. Freeman, M.E.I.C., and J. P. Mooney, A.M.E.I.C. One ballot was cast re-electing W. J. Johnston, A.M.E.I.C., to the office of branch secretary-treasurer.

A. R. Crookshank, M.E.I.C., who presided over the meeting, gave an address on "Port Development," as his farewell message as branch chairman.

S. R. Weston, M.E.I.C., newly-elected chairman, was then escorted to the chair and took charge of the meeting.

A vote of thanks to the branch officers for services during the past year and to A. R. Crookshank, M.E.I.C., for his address as retiring chairman was moved by G. G. Murdoch, M.E.I.C., and Geoffrey Stead, M.E.I.C.

A vote of thanks to the Press for courteous treatment in reporting branch meetings, also to the New Brunswick Telephone Company and Saint John Board of Trade for use of assembly halls during the past year, were moved by J. N. Flood, A.M.E.I.C., and E. G. Grant, A.M.E.I.C. O. J. Fraser, manager of the New Brunswick Telephone Company, replied briefly, assuring the branch members of the pleasure of the Telephone Company in making available its assembly hall for branch meetings.

Every feature of the dinner and annual meeting was a success, and while all reports and speeches were well received and comparisons may be out of order, it was generally conceded by all present that the high marks of the evening were the speech of W. J. Forbes-Mitchell, M.E.I.C., on The Engineering Institute, and the address of the retiring chairman, A. R. Crookshank, M.E.I.C., on Port Development.

Victoria Branch

K. M. Chadwick, M.E.I.C., Secretary-Treasurer.

On March 16th members of the Victoria Branch were addressed by Major N. C. Sherman, M.E.I.C., ordnance mechanical engineer, on the subject of mechanical warfare appliances from the early days of the Great War to present day developments. Major Sherman opened his address with a description of various types of field artillery, both mobile and heavy, and outlined the construction of the first tank used in the Great War. He described the powerful machine guns developed in England and United States, which he said were one of the most formidable weapons for combating tank attacks. Major Sherman's address was illustrated by many photographs, principally of tanks developed in Great Britain.

Executive Meeting

At a meeting of the executive committee of the branch, the chairman announced that the local branch had been asked to cooperate with the Oak Bay council in selecting a municipal engineer.

Hydro-Electric Developments at Alouette and Stave Lakes

On April 7th, E. E. Carpenter, M.E.I.C., described to members of the branch the large hydro-electric developments which are taking place at Alouette and Stave lakes.

Following Mr. Carpenter's address, which was illustrated by lantern slides, C. W. Colvin, electrical engineer to the British Columbia Electric Railway Company, described the electrical equipment of the power houses.

Visit to Lithographing Plant

Members of the branch had an interesting visit to the Colonist Lithographing Department on April 22nd, when they were shown the various processes of the work carried on by this organization.

Rainfall and Run-off

At a meeting of the branch on April 27th, at which R. F. Davy, A.M.E.I.C., vice-chairman of the branch, presided in the absence of Chairman E. Davis, M.E.I.C., an interesting and instructive paper was presented by E. G. Marriott, A.M.E.I.C., on the subject of "Rainfall and Run-off." Mr. Marriott illustrated his address with many lantern slides. He referred to records of precipitation on the Pacific coast, explaining in some instances the marked variation in rainfall in various sections of the province. He stated that there were 200 precipitation recording stations throughout the province which were closely linked up with 110 temperature recording stations.

At the close of his address Mr. Marriott was tendered a hearty vote of thanks.

Statistical Year Book of Quebec

The department of the secretary of the province of Quebec, Bureau of Statistics, has issued the 13th Statistical Year Book of the Province, which is for the year 1926. This volume should prove most useful, as it contains in concise form valuable data on a great many subjects. It is introduced by a chronological history of the province from its earliest date under the French regime, followed by a chapter on the physiography of the province. The statistical data is divided under ten principal headings: climatology, population, education, administration of the province, finances, production, communications and transportation, economic activity, organized labour, insurance and mutual benefit associations.

Under the chapter Education is included an interesting section on the cost of education, and under the heading of Production appears sub-sections dealing with the forest, mining and hydraulic electric power and central station industries, with a further section on the manufactures, including a survey of production in Canada. The chapter on Communications and Transportations includes sections on road, railways and automobiles, postal, telegraph and telephone stations and canals, and under Economic Activities appears data on the estimated cost of construction work by provinces.

Trade Publications

Hamilton Gear and Machine Company, Toronto, has issued a second edition of their catalogue of "Speed Reducers, Type T and Q," copies of which are available upon application to the company. The catalogue contains specifications for these speed reducers and also illustrations of the various types, with short descriptions and general data which should prove of value to those interested in such equipment.

Link-Belt Company, Chicago, has issued an interesting booklet entitled "Modern Methods in Coal and Ash Handling," which consists of a collection of five articles previously published separately. These articles are entitled "Coal and Ash Handling"; "Elevators and Conveyors for Coal Handling"; "Belt Conveyors and Skip Hoists"; "Bucket Conveyors and Storage Equipment," and "Equipment for Crushing Coal." This booklet, which is known as No. 530, contains fifteen pages, well illustrated with photographs of actual installations, and should prove of interest to those having to do with the handling of coal and ashes.

The company has issued another booklet, No. 575, entitled "Link-Belt Elevators and Conveyors," which is devoted principally to diagrammatic sketches and photographs of the company's various equipment for handling materials in industrial plants. In the ninety-six pages of this booklet the company has endeavoured to illustrate as many of the applications of elevating and conveying equipment as possible.

Combustion Engineering Corporation, Limited, Montreal has issued an interesting and attractive booklet entitled "An Achievement," which describes the new steam plant which the International Combustion Engineering Corporation of New York has recently completed for the New York Steam Corporation. This booklet gives a series of progress pictures of the construction of this large plant with illustrations of the various equipment installed.

The Westinghouse Electric and Manufacturing Company has just issued leaflets L. 20013-H and L. 20149-C, the first one describing the application, operation and distinctive characteristics of the LV autovalve arrester, and the second leaflet discussing the SV autovalve type. These leaflets may be obtained at any of the district offices of the Westinghouse Company or at the publicity department at East Pittsburgh, Pa.

Irving Iron Works Company announce the change of address of their Montreal office from 402 Coristine Building to 501 McGill Building.

Link-Belt Company, of Chicago, Ill., has issued in booklet form an address delivered before the Chamber of Commerce of the United States by the chairman of the company, Charles Piez, on "Midwestern Industries and the Panama Canal."

Institute Committees for 1927

FINANCE

J. H. Hunter, Chairman
J. L. Busfield
F. P. Shearwood
K. B. Thornton
O. O. Lefebvre

LIBRARY AND HOUSE

W. C. Adams, Chairman
S. F. Rutherford
R. De L. French
T. J. Lafreniere
Huet Massue

LEGISLATION AND BY-LAWS

George R. MacLeod, Chairman
J. B. Challies
O. O. Lefebvre
J. M. Oxley

PAPERS

J. L. Busfield, Chairman
K. L. Dawson
D. W. J. Brown
W. J. Johnston
C. S. G. Rogers
H. B. Pelletier
Louis Beaudry
S. W. Slater
C. K. McLeod
F. C. C. Lynch
R. C. Flitton
G. J. Smith
R. B. Young
H. A. Lumsden
F. C. Ball
W. Jackson
E. G. Ryley
A. H. Russell
G. P. Brophy
Jas. Quail
R. W. E. Loucks
Wm. Meldrum
W. R. Mount
W. St. J. Miller
K. M. Chadwick
P. H. Buchan

PUBLICATIONS

P. L. Pratley, Chairman
Lesslie R. Thomson
D. C. Tennant
A. Duperron
J. L. Rannie

GZOWSKI MEDAL AND STUDENTS' PRIZES

C. V. Christie, Chairman
C. R. Young
Ernest Brown
W. G. Mitchell
J. T. Johnston
J. H. Trimingham

LEONARD MEDAL

To be appointed

PLUMMER MEDAL

J. R. Donald, Chairman
Watson Bain
E. L. Eardley-Wilmot
G. P. Cole
K. L. Dawson

BOARD OF EXAMINERS AND EDUCATION

R. De L. French, Chairman
H. M. MacKay
Arthur Surveyer
J. M. R. Fairbairn
E. Brown
A. R. Roberts
T. J. Lafreniere
P. S. Gregory

CANADIAN NATIONAL COMMITTEE OF THE INTERNATIONAL ELECTROTECHNICAL COMMISSION

Howard T. Barnes, Chairman
A. Frigon
John Murphy
J. B. Challies
R. J. Durley
J. Kynoch
L. W. Gill
A. B. Lambe
H. A. Dupre
G. Gordon Gale
A. Lariviere
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Recent Developments in Boiler Furnaces

A Review of the Design of Various Types of Boiler Furnaces

B. N. Broido.

Deceased February 10th, 1927, formerly Chief Engineer, Industrial Department, The Superheater Company, Limited.

Paper read before the Montreal Branch of The Engineering Institute of Canada, January 6th, 1927

Engineering is largely a matter of economies. Its object is to obtain the desired results with the least expenditure of time, labour and money. This is particularly true in connection with the developments in the power plant field.

In the past years many improvements have been made effecting economies in the original cost and in the operation of practically all apparatus constituting a modern power plant, but there was no other problem in connection with power plants in which there was a more urgent need for improvement than in the design and construction of the modern boiler and furnace. The rapid improvement of the steam turbine and the possibility of concentrating more power generators in the large power stations created a demand for increased steam quantities. The logical progress has therefore been towards larger boilers, higher boiler evaporation per square foot of boiler heating surface, and also continuous operation over a long period at high average rating. This has made the problem still broader.

Stoker Development

Ever since the invention of the steam engine, coal has been burned in boiler furnaces. From the crude hand-fired grate type of the early days, the boiler furnace has passed through several stages of development to the modern furnace equipped with automatic stokers. Until 1910, when the automatic stoker began to be the prevailing method of firing, the furnaces were small and there was no serious difficulty or expense in maintaining them and no great loss if they were temporarily put out of service. The automatic stoker involved radical changes in furnace design. Modern stokers have more than doubled boiler evaporation per square foot of heating surface. More complete combustion, higher CO_2, and correspondingly higher boiler efficiencies are also obtained.

Stokers, however, are usually designed to give the best results with a certain grade of fuel, so that there was necessity for a method of combustion which would handle a variety of coals in order to be practically independent as to the kind of fuel.

Introduction of Powdered Fuel

Pulverized fuel was one solution of the problem. In order to reduce the initial installation cost and fixed charges the stoker-fired furnace grew larger and larger and the introduction of powdered fuel was a further step in increasing the size of boiler furnaces, as it was thought that large furnace volume was an inherent necessity for burning powdered fuel.

It was generally accepted that for every horse power generated at least 1½ to 2 cubic feet of combustion space were required, depending on the amount of volatile, moisture, ash, etc., of the coal, large volumes being thought necessary to allow sufficient time in the furnace for better mixing and more complete combustion of the hydro-carbons. The result was that the cost of construction of the large furnaces and the difficulties and expense of maintaining them in operation became exorbitant. Various methods were tried to reduce these difficulties. Air-cooled blocks were developed and used with some success. Hollow air-cooled walls were constructed and are being used advantageously under certain conditions.

Water-Cooled Furnace Walls

It became apparent, however, that in order to eliminate the erosion of furnace walls at the very high ratings, more effective means for cooling furnaces were required or that further steps would be necessary to eliminate the high maintenance cost of the present day large furnace. Attempts have been made before to water-cool furnace walls of water-tube boilers, but no serious consideration was given to them until Thomas E. Murray* decided to provide three additional boilers at the Hell Gate station of the United Electric Light and Power Company with so-called fin walls. These consist of water tubes with thin strips or fins welded to opposite sides. The tubes are located so that the strip on one tube butts on the strip of the next tube, forming a continuous metallic surface. Both side walls of the furnace are equipped with these water-cooled tubes. They have proven conclusively that not only was the maintenance of the furnace decreased but the capacity of the boiler was largely increased. These water-cooled walls have also demonstrated that tubes in a furnace are excellent evaporating surfaces, as they absorb a considerable amount of heat from the gases by radiation.

Particular attention was given to the circulation of the water. It is brought from the mud drum by outside pipes in the lower headers. The circulation in these water-cooled tubes seems to be so rapid that sediment or scale, and the consequent necessity of cleaning the inside of the tubes, is reduced to a minimum. The water-cooled side walls not only replaced practically all the brickwork in these side walls but afforded considerable protection to the front and side walls by absorbing the heat which they reflect.

The amount of cooling surface that can be installed, without lowering the furnace temperature to a point where the combustion would be affected, is dependent on the kind of coal used, particularly upon the kind and quality of volatile matter and ash in the coal, and also on the amount of moisture; all of which are important factors on the ignition temperature and affect the inflammability of the coal. The fusing temperature of the ash is also to be taken into consideration with respect to the slagging of the tubes: with preheated air, the amount of cooling surface can be increased.

Development in Furnaces for Powdered Fuel

The steady increasing pressures and ratings, the development of pulverized fuel burning equipment, water-cooled walls and air preheaters are revolutionizing boiler and furnace design. Since about eight years ago, when the first successful pulverized fuel installation in connection with a stationary steam boiler was put in operation, the furnaces for pulverized fuel underwent extensive developments without affecting the boiler proper.

It was found later, however, that the furnace cannot be separated from the boiler and both should be constructed as one unit. The development of water walls was the first step in this direction. The following requirements of powdered fuel furnaces made this necessary:—

(a) With pulverized coal, the fuel and air must be thoroughly mixed during the process of combustion.

(b) In order to justify the cost of preparing the fuel, the overall efficiency must be higher.

These require a higher CO_2 with correspondingly higher gas temperatures. However, the high temperature and the molten state of the ashes have a very bad effect on the brick walls. With earlier installations for burning powdered coal under steam boilers, which had refractory lined furnaces, considerable difficulties were encountered with the brick furnace from slag and the ash and rapid erosion of the firebrick furnace lining. The ash fused and accumulated in a molten or semi-molten condition at the bottom of the furnace and its removal, either hot or cold, required much hard labour and caused long shutdowns of the boiler.

The fused ash, coming in contact with the refractory, ran down the walls, eroding the brick and washing the slag to the bottom of the furnace. Under such conditions, firebrick lining lasted only a comparatively short time and required frequent repairs. Naturally, the washing away of the brick lining was particularly rapid where the flames were allowed to impinge on it. In order to prevent impingement of the flame, the furnaces were built large enough to keep the walls away from the flame. The furnaces were therefore larger than actually necessary for good combustion. Where this was not the case, the refractory deteriorated after a few months of operation.

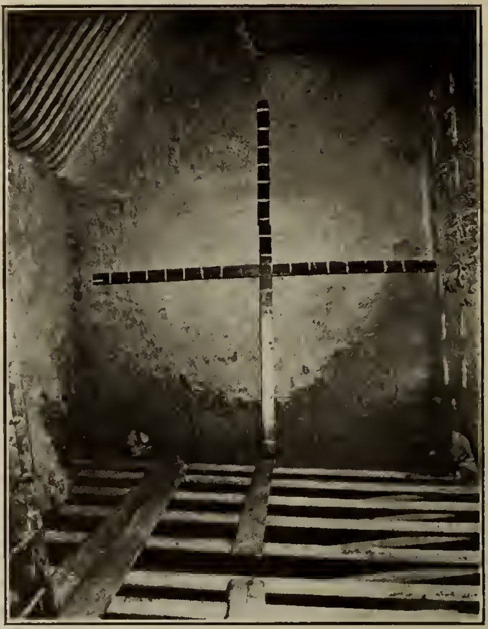

Figure No. 1.—Interior View of Furnace of Semi-Vertical Boiler Fired with Powdered Coal after about Six Months Operation.

Figure No. 1 is a reproduction of a photograph taken in a furnace of a semi-vertical boiler fired with powdered coal after about six months of operation. At the point where the fuel turns and the mixing with the air is completed, rapidly increasing the temperature and volume of the gases, the refractory lining is completely eroded or fused and washed down by molten ash.

It has been stated repeatedly that it is not as hard to burn coal, particularly after it has been brought in contact with air, as it is to bring the necessary amount of air in contact with each particle of coal. In order to burn a particle of coal, approximately fourteen thousand times its volume of air is required. The combustion of a particle of coal can therefore be completed only after this entire amount of air has come in contact with it. From this, it is evident that thorough mixing of coal with air is required for complete combustion. In an effort, however, to prevent the impingement of flames on the firebrick linings, the turbulence of the furnace gases was limited to a minimum. It made the process of combustion very slow, so that only a comparatively small amount of coal could be burned per cubic foot of combustion space. Early installations of pulverized fuel were therefore designed with a maximum liberation of 15,000 to 25,000 B.t.u. per cubic foot per hour. With no means provided for mixing the coal and the air, it was found that even the finest particle of pulverized coal required from one to two seconds in order to be burned completely. Hence, a large furnace was provided to permit these particles of coal to remain in the combustion space from one to two seconds.

* Designing Engineer, New York.

The action of the fused ash, the changing temperature of the flame, and the heat, particularly in the lower part of the furnace, were responsible for the quick destruction of the refractory. Efforts were made to produce refractories that would resist the erosive action and would better withstand the higher temperatures, but as the composition of coal ash varies so much it was extremely difficult to produce a refractory material that would resist all kinds of coal.

Air-cooled hollow walls improved the situation considerably, but did not entirely solve the problem of erosion. Special mechanical means of steel or cast iron construction were designed in order to relieve the weight of the brick upon the lower part of the wall, and to take any of the expansion and contraction due to change in temperatures, but these are very expensive. The above mentioned development of a water-cooled furnace wall was, therefore, at least for certain conditions, the only solution.

Radiation in Boiler Furnaces

A great deal of thought has been given recently to the laws of heat radiation, due to the fact that its importance in furnace design has been recognized. In the modern large furnace, filled with flame or gases of combustion, a great amount of heat can be lost by radiation, not only from incandescent solid fuel but also from the gases of combustion. In a paper presented last year by the writer before the American Society of Mechanical Engineers, entitled "Radiation in Boiler Furnaces,"* it was shown how the experiments of Dr. Shack can be utilized in order to determine the heat radiated from gases of combustion to water-cooled surfaces. It was definitely established that some of the constituents of furnace gases, particularly carbon dioxide and water vapour, radiate heat. Experiments have shown that the radiation of a flame increases with its thickness up to about twenty-four inches. Above that, no increase in radiation takes place. The radiation from a flame with a thickness of twenty-four inches or more is about 7.5 per cent of that of a black body of the same temperature, when the flame contains by volume about 14 per cent of CO_2 and 7 per cent of water vapour. The radiation from a flame in a pulverized fuel furnace is much greater, as it contains, in suspension, a considerable amount of incandescent particles of fuel and hot ashes, both of which are very effective heat radiators.

In the above mentioned paper, the writer pointed out that, assuming a furnace of cubical shape filled with flame and provided with a grate at the bottom, the surface of the flame would be just five times the area of the grate. The radiation from the flame is therefore about 60 to 65 per cent of that of the fuel bed. This shows that the radiation of a flame is an important factor in computing the heat absorbed in a boiler furnace.

In two papers* presented before the American Society of Mechanical Engineers, Professor W. J. Wohlenburg and others have elucidated an elaborate method computing the radiant heat that can be absorbed within a boiler furnace fired with pulverized fuel. They have shown that the radiation from the small particles of coal in suspension in the furnace is still higher than from the gases of combustion. This is probably due to the fact that while a flame, as experiment has shown, becomes opaque to its own radiation at a depth of over three feet, it is apparently transparent to radiation from other bodies even at a considerably greater depth.

* Mechanical Engineering, vol. 48, no. 2, Feb. 1926, pp. 133-137.

* American Society of Mechanical Engineers.—Advance Paper for Meeting Dec. 6-9, 1926.

In order to obtain the highest furnace temperature, and, accordingly, the highest efficiency, it is desirable to have the most rapid agitation and combustion possible. The coal entering the furnace must first be heated, and any moisture in the coal must vapourize, before combustion can begin. At about 400° F. the gases and volatile vapours are given off. After the gases of distillation and the admitted air have reached the ignition temperature the combustion of the gases commences. The burning volatile matter produces water vapour and carbon dioxide, both of which will absorb and radiate a considerable amount of radiant energy. Thus, the combustion process consists of two parts: heat absorption and heat liberation. The time, as well as the space, required for combustion will be less the higher the furnace temperature, the dryer the coal, the higher the temperature of the admitted air and the better the coal and the air can be mixed. Water-cooled surfaces unquestionably reduce the furnace temperature. This can be compensated for, at least to a certain extent, by preheating the air for combustion and by a turbulent mixing of air and fuel in the furnace. The following paragraphs are intended to show the relation between these factors of combustion.

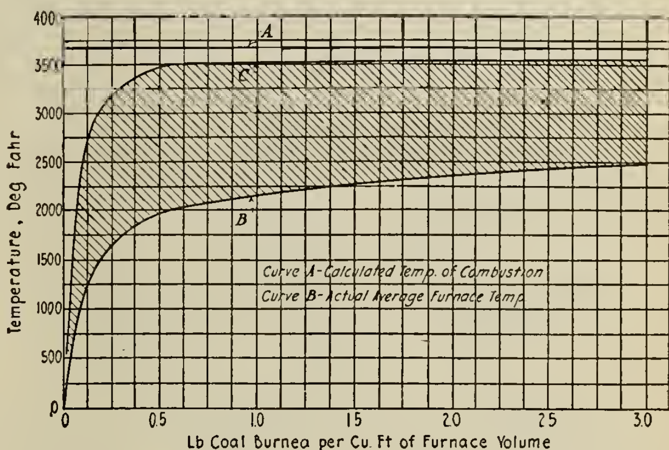

Figure No. 2.—Comparison of Actual and Theoretical Flame Temperatures at Different Coal Rates.

Heat Absorption by Radiation

The heat absorbed by radiation per square foot of surface depends upon the amount of fuel burned and the amount of heating surface that is located in the furnace, both of which influence the temperature of the flame or gases in the furnace.

Figure No. 2 shows how the temperature of the flame varies with the amount of coal burned, also the influence of water-cooled walls upon this temperature. It is based on a furnace 18 feet long, 18 feet high and 24 feet wide, fired with coal having a calorific value of about 14,000 B.t.u. per pound and burned with 14 per cent of CO_2. The first two lower rows of the boiler present about 700 square feet of surface absorbing heat by radiation, and there is also heat-absorbing surface of about 1,000 square feet in the water-cooled walls and bottom.

In figure No. 2, curve *A* represents the calculated or theoretical furnace temperature which would result from combustion with the above coal without any losses. Curve *B* represents the actual average temperatures in the furnace under the above conditions with different rates of fuel consumption. Curve *C* shows what the temperature would be

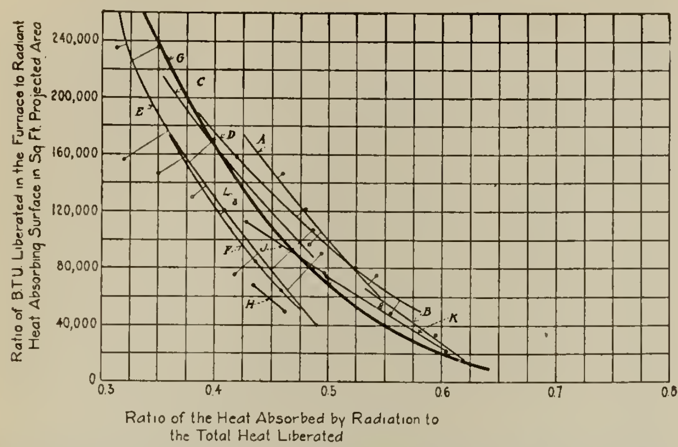

Figure No. 3.—Curve showing Relation between Total Heat Generated in the Furnace and that Absorbed by Radiation.

if no water-cooled radiation surface were present to absorb heat. The shaded portion between curves *B* and *C* represents the temperature drop in the furnace due to heat absorption by radiation. Curve *B* approaches curve *C* as the ratio of combustion increases, which shows that the heat absorbed by radiation does not increase in the same proportion as the fuel burned.

The most important factor in connection with heat radiation is the relation between the total heat generated in the furnace and that absorbed by radiation; in other words, the fraction of generated or liberated energy which is absorbed in the furnace. The author endeavoured to figure this relation for a few cases, either directly where the amount of steam generated by the radiation heat-absorbing surfaces was known or indirectly by comparison with similar cases where water-cooled surfaces are not provided. There seems to be a certain relation between the ratio of the total heat liberated in the furnace to the radiant heat-absorbing surface, and to the heat absorbed by this surface.

Figure No. 3 is taken from the above mentioned paper, "Radiation in Boiler Furnaces." The curves, however, are completed and corrected in accordance with more recent practice. The heavy curve *G*, which represents the average of the others, is sufficiently accurate for practical purposes to be used as a standard on which to base calculations. By means of this standard curve, one can determine what part of the total heat generated will be absorbed by the radiating surface in the furnace for a certain rate of operation of the boiler. This can be found by determining first the ratio of the total heat to the total amount of radiating surface. The total heat should then be multiplied by the figure of the abscissas corresponding to the determined ratio, which gives the total heat absorbed by radiation. This curve can also be used to find the heat transmission by radiation per square foot of heating surface for any given condition of the furnace. Determine the total amount absorbed by radiation as before and divide it by the number of square feet of surface exposed to radiation.

Very often the question arises as to how much steam will be evaporated by the water-cooled surface located in the furnace; that is, the water walls and bottom screen. That this problem can be solved easily by the use of the standard curve *G* of figure No. 3 is evident. The number of B.t.u. absorbed by radiation per square foot of surface should be multiplied by the amount of radiating surface in the furnace in square feet.

The curve *G* in figure No 3 is based on average-sized furnaces of about cubical shape. It can be applied for rates of heat liberation between 8,000 and 32,000 B.t.u. per cubic foot.

Table No. 1 shows the heat transfer per square foot of projected area of the side wall of a standard water-tube boiler of about 1,600 h.p. for different percentages of radiant surface and amounts of coal burned.

Table No.1—B.t.u. transfer per square foot of projected area per hour to furnace-wall surface of standard water-tube boilers.

Millions B.t.u. liberated per hour in furnace	Furnace-wall surface in square feet					
	250	500	1,000	1,500	2,000	3,000
50	29,300	21,800	16,400	13,600	11,400	8,400
100	49,500	41,000	31,000	24,600	20,500	15,200
150	66,000	55,500	42,200	34,200	29,500	22,300
200	77,200	67,300	52,600	43,400	36,700	28,600
250	90,700	79,000	61,800	51,000	44,000	34,000
300	98,600	86,200	69,400	58,500	51,000	39,200

This table is based on boiler having 480 square feet of projected area exposed to radiation in the furnace.

Furnace Temperatures with Water-Cooled Walls

Figure No. 4 is calculated to show what furnace temperature can be expected in a furnace burning pulverized fuel at different rates of heat liberation per cubic foot of furnace volume and for different amounts of water-cooled surface. The method of calculation disclosed in the above mentioned paper by Wohlenburg and others was used. The curves are based on a furnace of about twenty feet on all sides. In accordance with figure No. 4, the furnace temperature decreases rapidly with decreased rate of heat liberation per cubic foot of furnace volume; it also decreases with increased amount of water-cooled surface. It is, however, even with a furnace covered on all sides with water-cooled surfaces, still 2,100° F. when 20,000 B.t.u. are liberated per cubic foot of volume. It should be remembered, however, that figure No. 4 shows average temperatures, and that the gas temperature near the walls is considerably lower. It would be, therefore, hardly advisable, under these furnace conditions, to use certain kinds of coal; for instance, those with a low volatile and high moisture content. It is hoped these curves will be of value in determining the furnace design for a given condition and that it will assist in the determination of the size of the furnace and the amount of water-cooled surface to be installed.

Preheated Air

Preheated air increases the furnace temperature considerably under certain conditions. Figure No. 5 gives the furnace temperatures for various rates of heat liberation, various amounts of water-cooled surfaces and for preheated air of 70° to 570° F. It is based on bituminous coal of about 13,500 B.t.u. heat content, approximately 30 per cent vola-

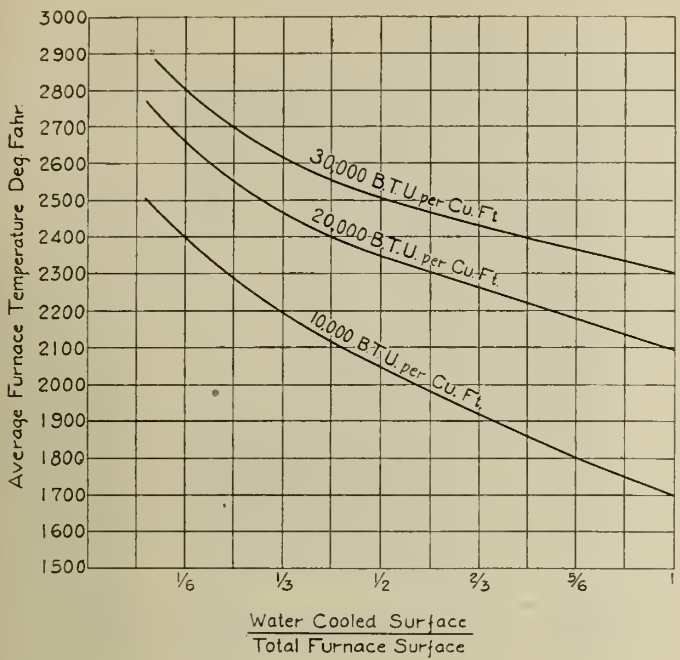

Figure No. 4.

tile and when burned with about 25 per cent excess air. The less the water-cooled surface, the more the furnace temperature increases, with higher temperatures of the air for combustion.

The actual benefit from preheated air is considerably greater than is indicated on these curves. The time and the heat required to bring the air up to the furnace temperature are considerably reduced when the air is preheated. Less space is therefore required to burn a given amount of fuel, or, in the same space, the combustion will be completed earlier.

With preheated air, more water-cooled surface can therefore be allowed and still have complete combustion, without any danger of smoking.

With the present high rates of combustion used in steam boiler practice, there is very little danger that water-cooled furnace walls will cause incomplete combustion by excessive cooling of the flame, particularly when the air is sufficiently preheated. The temperature of the flame is then high enough for anything to burn as long as the supply of air is sufficient and the air mixes properly with the fuel particles.

The fact that air-cooled walls make it possible to use highly preheated air is a very important factor in power plant design. The practice of bleeding turbines for heating feed water is growing rapidly, not only because it is considered a good means for heating water, but because it also improves the thermal cycle of the plant appreciably. The heating of feed water in this way limits the use of economizers; air heaters being used instead. With the use of preheated air, however, when no water walls are provided, the furnace temperature is very high, which increases the wear on the refractory walls.

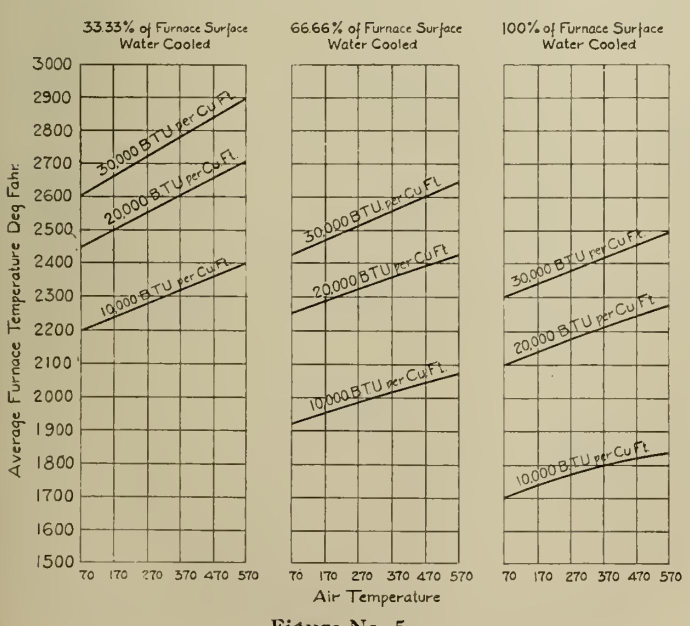

Figure No. 5.

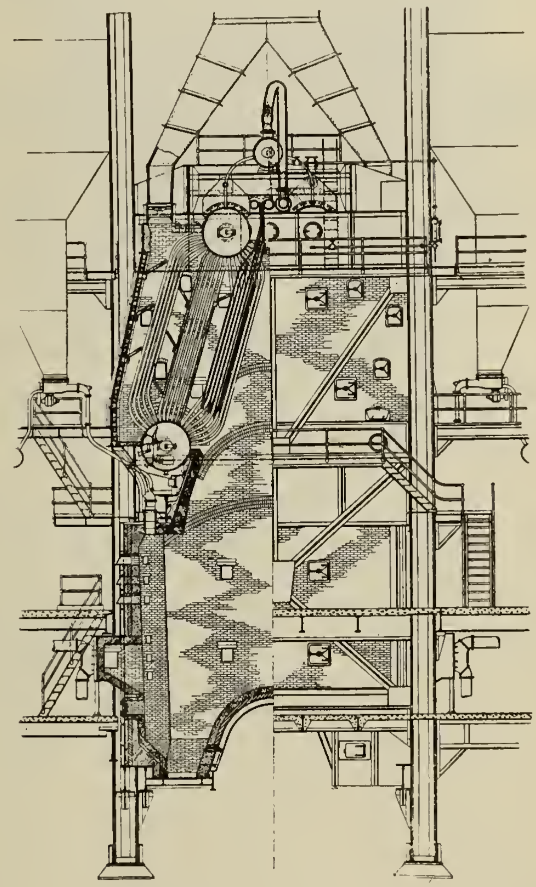

Figure No. 6.—Section of One of Eight Boilers as Originally Installed in Fordson Plant.

Difference in Operation with and without Water Walls

The difference in operation of boilers without and with water walls is admirably illustrated at the Fordson plant, (formerly River Rouge), of the Ford Motor Company. Figure No. 6 shows one of the eight boilers installed in this plant. They are rated at 2,647 h.p. The maximum rating which can be obtained with these boilers, without affecting the brick walls, is 250 per cent.

Originally laid out in 1919, the Fordson power plant was designed for a generating capacity of 65,000 kw. The ultimate capacity soon was raised to 100,000 kw. Then, the unprecedented growth of the Fordson plant, delivery of energy to other Ford plants and the electrification of the Detroit, Ironton and Toledo Railroad so altered require-

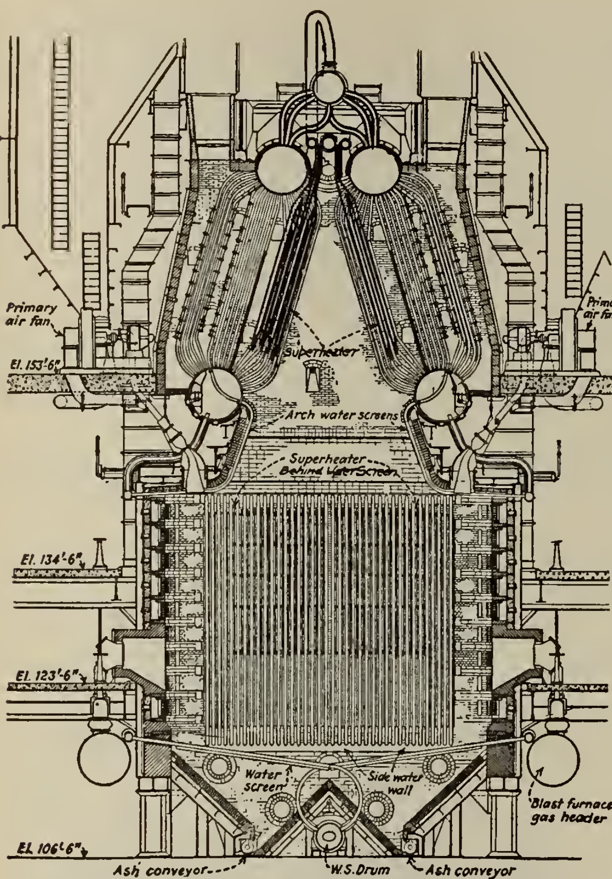

Figure No. 7.—Section through Boiler and Revamped Furnace of Fordson Plant.

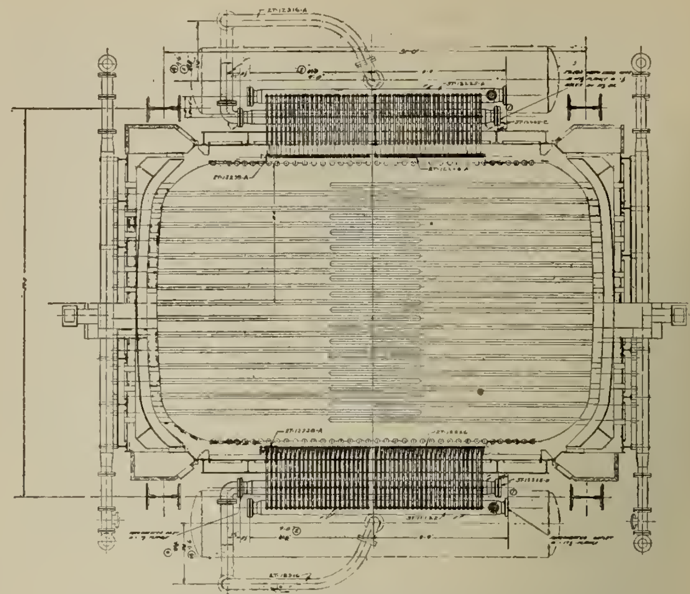

Figure No. 8.—Horizontal Section through Revamped Furnace of Fordson Plant.

ments that a greatly enlarged power programme became essential. It is now planned that the ultimate capacity of the plant will be 240,000 kw.

The eight boilers now installed take practically all the allotted space for boilers. Although these boilers have been designed for continuous running at 250 to 300 per cent of nominal rating, when burning simultaneously blast furnace gas and powdered coal, the aggregate capacity must be more than doubled to meet the ultimate demand for steam. With no space for additional units, this could be done only by increasing the fuel burning capacity and operating at higher ratings. Fortunately, there was space to widen the furnace and make them somewhat deeper, thus giving greater furnace volume. It was therefore decided to redesign the furnaces.

On the first furnace to be changed the fuel burning capacity was increased so that the boilers could be operated up to 660 per cent of rating. Water-cooled walls were provided for the side walls and a water screen across the bottom of the furnace. The work on one furnace, which was completed a little over a year ago, has proved successful, and three of the other remaining seven boilers are scheduled to be changed over shortly.

The Elesco superheaters of the convection type in the first bank on either side were retained, but were increased in capacity. In addition, since even this increase in capacity would not be sufficient to take care of the increased output of steam without undue pressure drop, Elesco radiant type superheaters were also installed on either side of the furnace behind a portion of the water-cooled walls. The radiant type superheaters are protected from excessive temperature by the side wall surface, and, at the same time, owing to omission of fins on the side wall tubes at this point, will absorb radiant heat from the fire. Figure No. 7 is a section through the boiler and revamped furnace, while figure No. 8 is a horizontal section through the furnace showing the water-cooled tubes at both side walls, also the radiant type superheater behind these tubes.

Reports of the boiler house showed that the steam generation of boiler No. 2, which was changed, was more than twice that of any of the other boilers. While the maximum of any one of the unchanged boilers was 3,900,000 pounds of steam per day, the production of No. 2 boiler was 8,600,000 pounds. In addition to the increased production, the maintenance cost of the brickwork was considerably reduced.

Designs of Water-Cooled Walls

There are different designs of water-cooled walls. Some have steel tubes exposed directly to the furnace. With

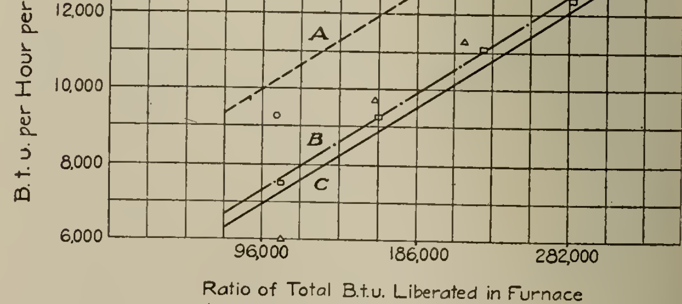

Figure No. 9.—Evaporation per Square Foot of Surface Depending on Total Amount of Heat Liberated.

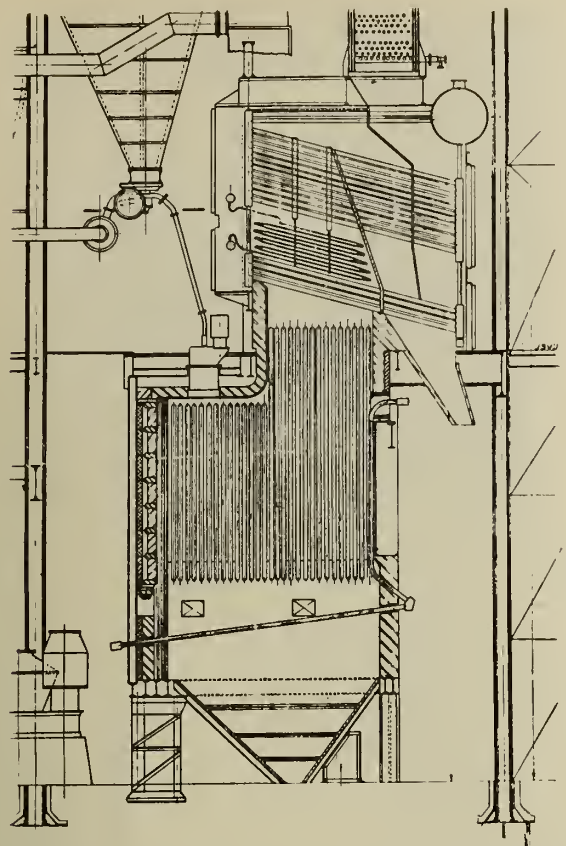

Figure No. 10.—Section of One of Boilers being Installed in New Super-power Station for the City of London, England.

others the tubes are covered with cast iron. There is also a design on the market where the cast iron is covered with refractory.

While figure No. 3 gives the evaporation obtained with water walls in different boilers, in all cases the water walls consisted of bare tubes. Very little was known about what evaporation can be expected from a Bailey wall, where the tubes are covered with cast iron protected by a refractory.

Recently, Mr. Funck, of the Philadelphia Electric Company, read a paper before the Engineers' Club of Philadelphia, giving results obtained with the Bailey type of water walls. Figure No. 9 is based on this result and gives the evaporation per square foot of surface, depending upon the total amount of heat liberated in the furnace.

In the United States, the so-called fin tubes arrangement is most extensively used. It consists of a tube of standard size and gauge to which has been welded two flat steel bars, one on each side. A number of such tubes in a single row make practically a continuous surface. In most cases 4-inch tubes are used. The flat steel bars are 1½ inch wide and ¼ inch thick. One of the flat surfaces is exposed to the radiant heat of the flame. This radiant heat is transmitted by conduction to the tube and hence to the water inside the tubes.

Figure No. 10 is a section of one of nine large boilers now being installed in the new super-power station to provide electric light and power for the city of London, England. The boilers will be fired with pulverized coal, and there are about 1,200 square feet of water-cooled surface in each furnace. Interdeck superheaters of the Elesco type will raise the temperature of the steam to 725° F. at normal load and to 760° at maximum load.

A horizontal water-tube boiler, stoker fired, provided with this type of water-cooled wall is shown in figure No. 11. It is one of boilers Nos. 71 to 73 of the Hell Gate station of the United Electric Light and Power Company in New York. Two side walls are water-cooled. The boilers are provided with Elesco superheaters.

To avoid any possibility of difficulties near the surface of the stoker the lower ends of the tubes are covered with refractory tiles up to about the height of the upper end of the stoker. The water circulation through the tubes seems to be ideal. Water is brought from the mud drum by outside pipes to the lower headers, which gives an exceptionally long cold leg for inducing flow through the tubes in the furnace. It is claimed that the circulation is so rapid that very little scale accumulates insides the tubes. During the

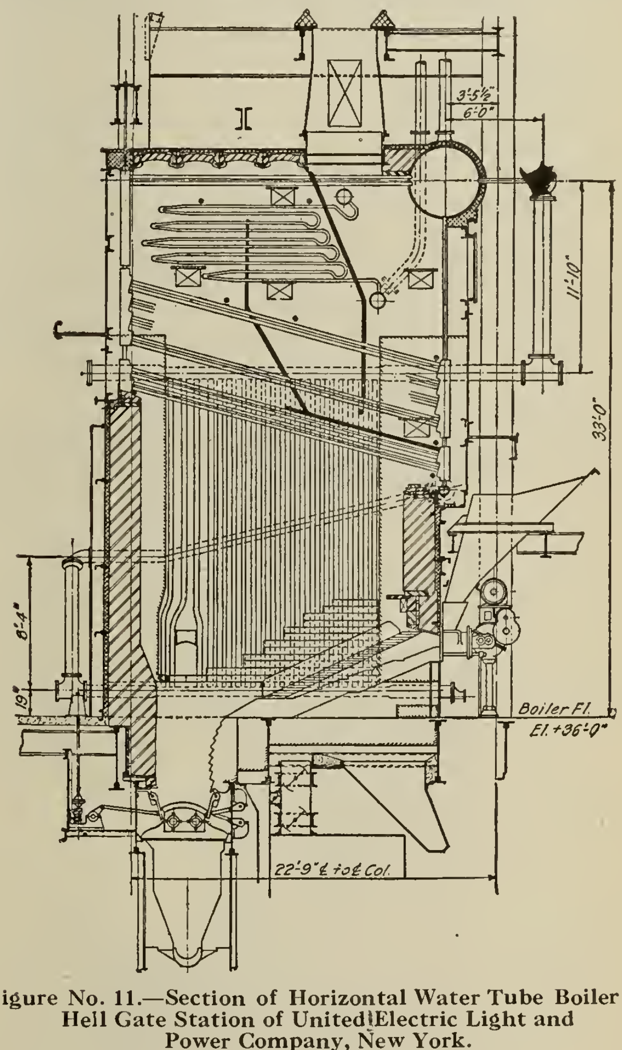

Figure No. 11.—Section of Horizontal Water Tube Boiler of Hell Gate Station of United Electric Light and Power Company, New York.

first two years of operation practically no cleaning has been necessary.

Figure No. 12 illustrates one of the six Springfield boilers fired with pulverized fuel recently installed at the East River station of the New York Edison Company.

The furnace of this boiler is completely cooled, having water tubes on all sides as well as across the bottom. The arches are also cooled by specially arranged tubes.

As the gases near the side walls will be colder than in the centre, a special arrangement of the boiler tubes was required in order to obtain the high degree of superheat. In the centre of the boiler there are four tubes below the superheater, while at the side walls there are only two tubes. It is expected that in this way the gases entering the superheater will be of uniform temperature over the entire width of the boiler. With this tube arrangement the gases are also better distributed, as the omission of tubes compensates for the friction near the side walls.

Figure No. 13 is another section of the same boiler on which the arrangement of water tubes mentioned above is clearly seen.

A semi-vertical boiler provided with fin type water-cooled walls is illustrated in figure No. 14. The first boilers in this particular plant were installed without water walls, and the effect of the flame on the wall is shown in figure No. 1. Figure No. 15 is a cross-section through one of the boilers of the New York Steam Company, and figure No. 16 a view of a water-cooled wall where the tubes are covered with cast iron blocks, with a section through the walls shown at the side, and also the original as well as the more recent shapes of the blocks.

The Bailey water wall, which is illustrated in figure No. 17, consists of steel tubes rolled into headers, with the side-wall blocks cemented to the tubes and held in place by clamps attached to the blocks. Refractory is plastered into the blocks after they have been placed in the furnace. In the original installations the refractory became loose and the conductivity was reduced to such an extent that the refractory was damaged. In more recent installations the block has been made by pouring molten cast iron around the refractory. With this arrangement it is claimed that the refractory remains tight in the casing. Figure No. 18 is a cast iron covered water-cooled furnace bottom.

The heat transmission from the gases through the tubes, with the water-cooled walls just described, is approximately one-quarter of that of a bare-tube wall. The bare-tube walls have proved to be excellent heat absorbers, so that the capacity of the boiler is therefore considerably increased if provided with this type of water-cooled wall. In considering the cost of a water-cooled wall this should be taken into consideration. The heat transmission with the Bailey water wall is considerably less and its value as an evaporator is comparatively low. From this point of view it is therefore very expensive as a furnace wall.

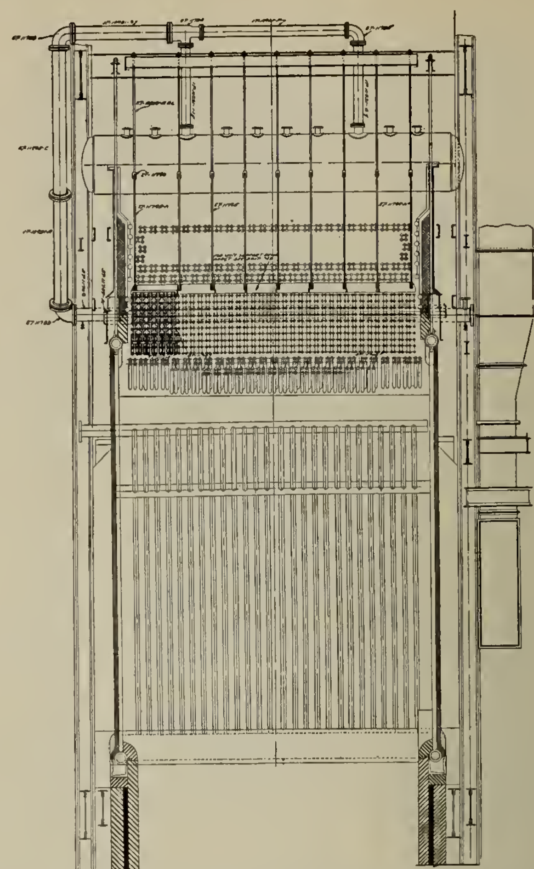

Figure No. 13.—Section of One of Springfield Boilers Installed in East River Station of United Electric Light and Power Company, New York.

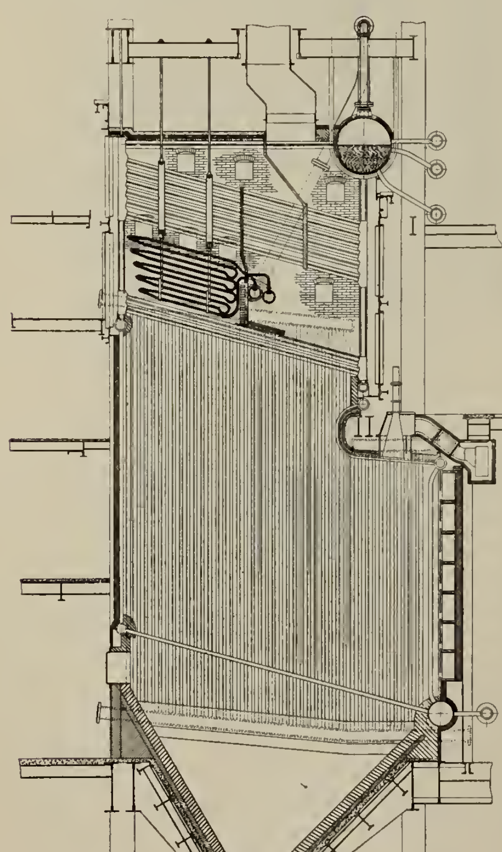

Figure No. 12.—Section of One of Springfield Boilers Installed in East River Station of New York Edison Company.

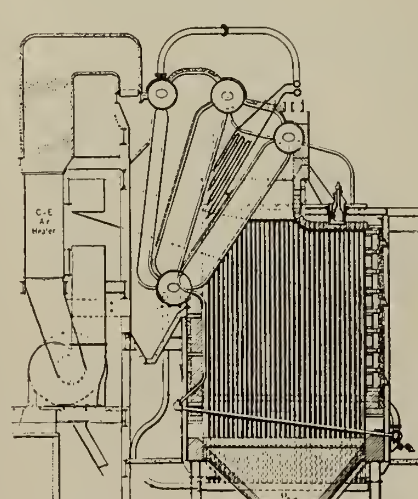

Figure No. 14.—Section of Semi-Vertical Boiler Provided with Fin Type Water-Cooled Walls.

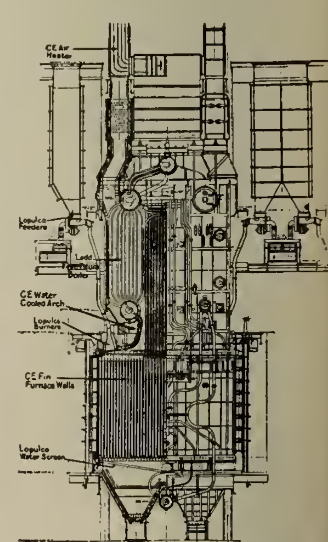

Figure No. 15.—Section through One Boiler of the New York Steam Company.

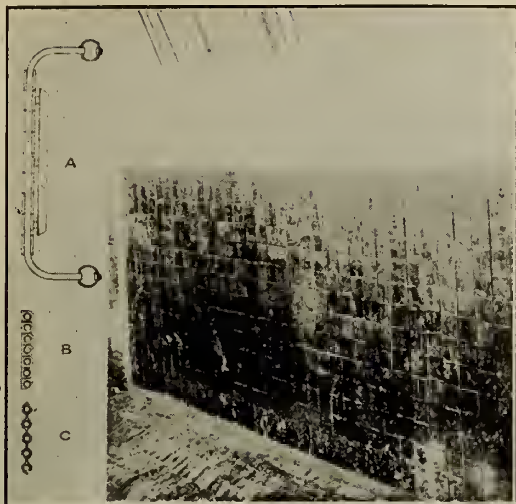

Figure No. 16.—View of Water-Cooled Wall with Tubes Covered with Cast Iron Blocks.

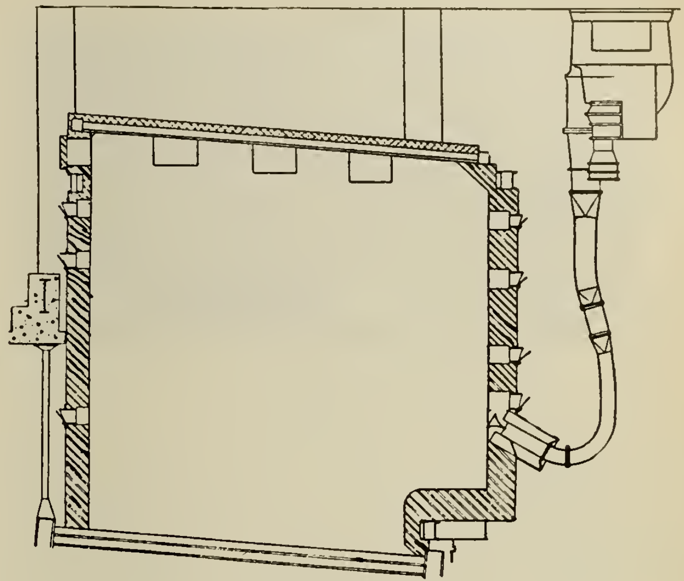

Figure No.—18.—Cast Iron Covered Water-Cooled Furnace Bottom.

Water-walls With Bifurcated Tubes

A new development in water wall design was recently applied in Canada at St. Maurice valley, in the province of Quebec. A section through the boiler showing also the water walls is shown in figure No. 19. Figure No. 20 is a reproduction of a photograph of the tubes taken at the manufacturing plant before shipping. These are so-called bifurcated tubes and consist of two tubes joined together to form a single terminal by means of a special forging process. In this particular case two 3½-inch outside dimension tubes are forged to form a 4-inch outside dimension terminal, which in turn is rolled into the header the same as a single 4-inch outside dimension tube.

This design has advantages worth mentioning. When standard tubes are rolled into headers, sufficient space must be provided between them in order to leave enough metal for strength. As previously mentioned, one design provides fins on each side of the tubes in order to make a complete metallic wall. With others, blocks are used in order to make a continuous surface. With the double arrangement, or the so-called bifurcated tubes, the tubes can be spaced much closer, so that the wall will be entirely covered with them. For the same amount of water-cooled surface there is just half the number of joints between the tubes and the header, also just half the number of hand holes.

With the bifurcated tubes more heating surface can be placed per square foot of wall, the relation of which is as follows:—

Bifurcated tubes	Fin tubes	Plain tubes
148.8 sq. ft. heating surface.	108 sq. ft. heating surface. (Considering the sq. ft. of the fin 50% effective as compared with the tube surface.)	85 sq. ft. heating surface.

For each 100 square feet of heating surface, assuming the tubes are 10 feet long, there will be:—

Bifurcated tubes	Fin tubes	Plain tubes
11 tube holes and 11 handholes in each header.	15 tube holes and 15 handholes.	19 tube holes and 19 handholes.

The main advantage of the bifurcated design is that it constitutes practically a continuous cooled wall, and the

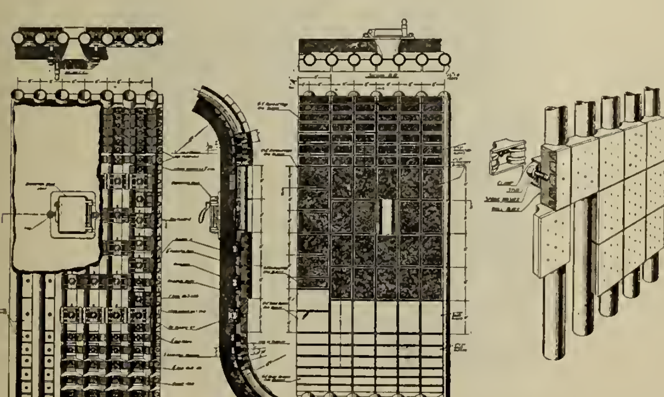

Figure No. 17.—The Bailey Water Wall.

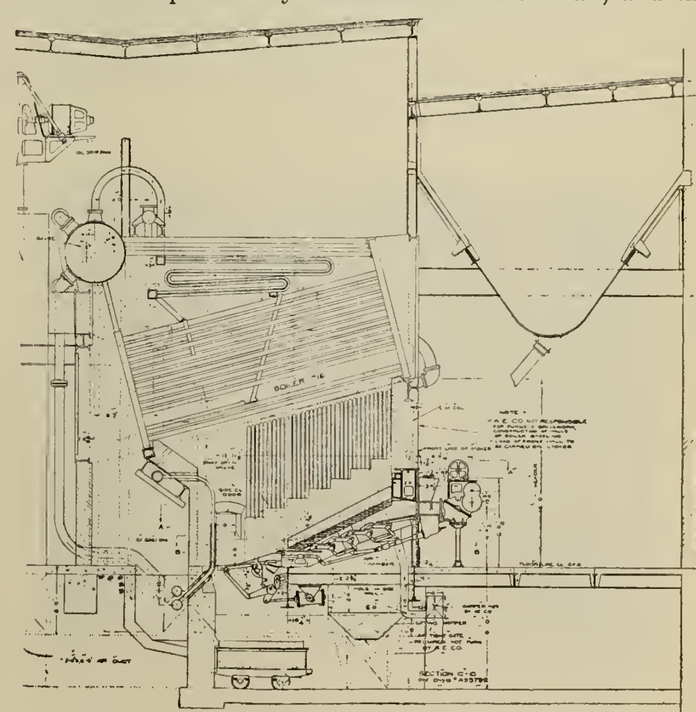

Figure No. 19.—Section through Boiler with Water Walls with Bifurcated Tubes.

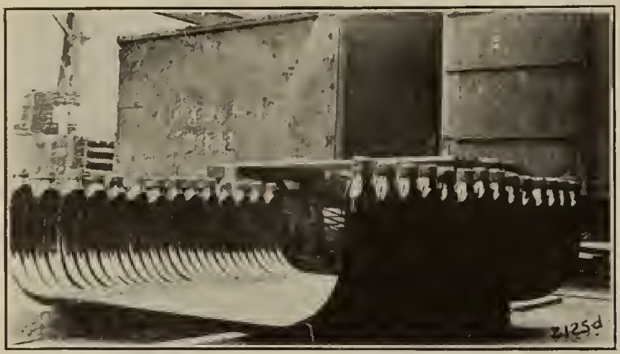

Figure No. 20.—Bifurcated Tubes at Manufacturing Plant before Shipment.

entire heating surface exposed to the furnace is cooled by water. Furthermore, the tubes are not weakened in any way, (by welding), which is a very important point in connection with a water-cooled wall where the tubes are located directly in the furnace and exposed to the highest temperature.

Figure No. 21 shows the application of bifurcated tubes in the side walls. Due to the bend at each end of the tubes they are very flexible for expansion. The headers being located outside, the joints are readily accessible.

The tubes consist of plain bent tubes rolled into the top and bottom headers and are protected with cast iron where the ash and slag would come in contact with them. The cast iron also protects the tubes from slice bars and hooks that may be used to break up clinker. The tubes in the side walls are exposed to the furnace temperature except for a short distance above the stoker line, where they are covered with a refractory tile in the furnace.

Figure No. 22 is a rear view of the bridge wall. The proper circulation in this water wall is accomplished by feeding the bottom headers at the middle of the wall and taking the steam from both ends of the top headers.

As mentioned at the beginning of the paper, with the introduction of pulverized fuel it was recognized more than ever that the boiler cannot be separated from the furnace. The tendency is very noticeable, therefore, to combine the furnace and boiler in one unit.

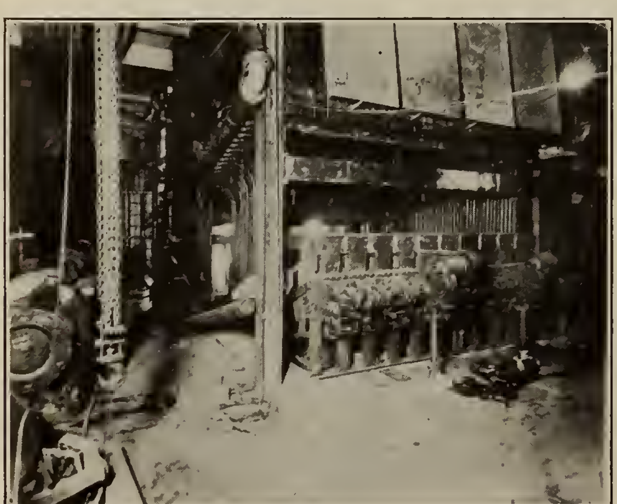

Figure No. 21.—Application of Bifurcated Tubes to the Side Walls.

Steam Generator

The new steam generator is practically a boiler built around a furnace. One steam generator has been in operation for about a year in Manchester, England. A number of them are now being installed in the United States, and before long results of operation will be available.

Burroughs Boiler

A wide step forward, towards combining a boiler and furnace, was made by Mr. Burroughs of Montreal. The arrangement of the furnace and the boiler, also the circulation, as well as the auxiliaries, are clearly indicated. It will be noted that the pulverized fuel is fed through an

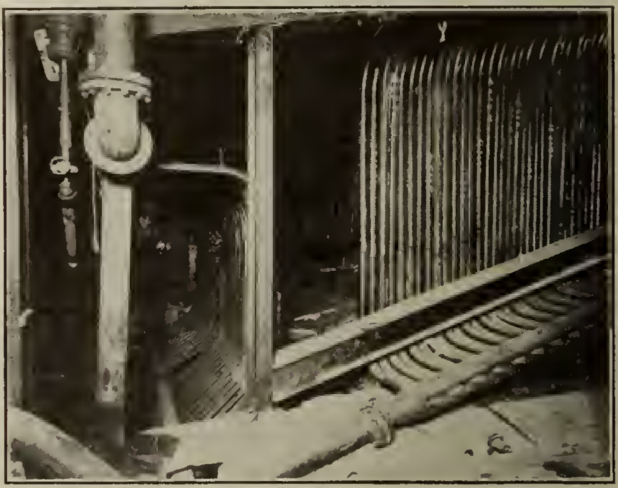

Figure No. 22.—Rear View of Bridge Wall.

opening in the centre of the top drum and the preheated air enters the furnace between the tubes near the top.

Figure No. 23 illustrates the Burroughs boiler erected, ready for bricking-in. It shows the tubes around the furnace, and the manner in which they are connected at the top and bottom drum. Figure No. 24 is a photograph of the boiler with the bottom drum of the furnace in the foreground, before the furnace tubes were put in place. The

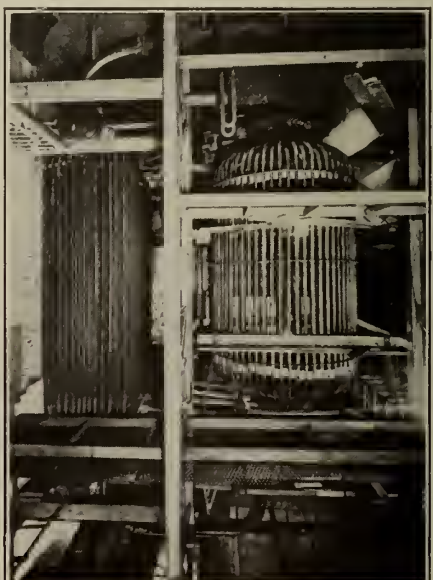

Figure No. 23.—Burroughs Boiler Erected.

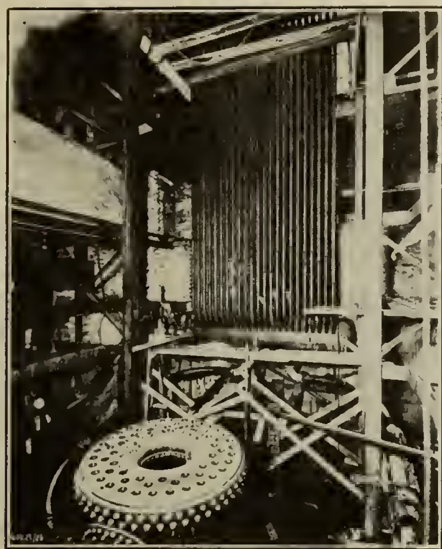

Figure No. 24.—Burroughs Boiler with Bottom Drum of Furnace in Foreground.

opening in the middle of the drum is to allow the ashes to fall through to the ashpit from which they can be removed easily during operation. The drum is insulated and bricked-up to protect it from the hot gases flowing from the furnace to the boiler.

Insulation of Water-Cooled Walls

It is only within the last few years that the magnitude of heat losses from boiler and furnace walls has become generally recognized and consistent attempts made to minimize the loss. Extensive research has, for several years, been carried on to determine the insulating characteristics of a wide variety of material suitable for use in furnace walls. While furnace walls are made of brick, the difficulties of obtaining the proper material were due to the exacting requirements which are imposed upon them by the severe temperature conditions of the furnace. The demand for high ratings and increased boiler efficiency raised the temperature of the furnace and the insulating quality of furnace wall materials became of more importance.

To avoid the excessive thickness of wall which would be required if firebrick lining were used, various other materials were applied in conjunction with firebrick, either Sil-O-Cel or others. These materials have high thermal resistance, but their other properties are not suitable as firebrick for direct contact with flame. They are not sufficiently strong at high temperatures and their melting temperatures are rather low. The conductivity of ordinary firebrick is approximately 12 B.t.u. per degree per square foot per hour for a wall one inch thick, while the conductivity of some of the other materials used for insulation is less than one B.t.u. per degree per square foot per hour. The cost, of course, of some of the other materials is considerably higher than firebrick.

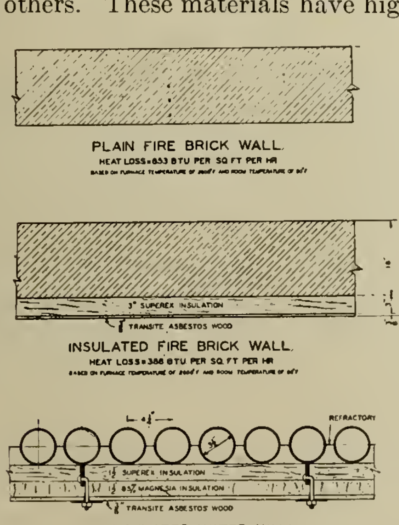

Figure No. 25.—Comparison of Heat Loss through Three Walls.

The development of the water-cooled furnace walls simplified the problem. The metal of the tubes is only at a slightly higher temperature than the water, so that all that is necessary is to insulate these tubes.

The principal elements of the construction of modern water-cooled furnace walls are the water tubes and the insulation. However, the refractory, while used in relatively small quantities, is still an essential part of the construction, since it is used to prevent direct radiation and flame impingement on the insulation. This refractory is used between or around the tubes, and in some cases is placed on the surface of cast iron blocks on the furnace side of the tubes. These developments have resulted in greatly decreased heat losses from boiler furnace walls.

A comparison of the heat loss through three walls, each a typical example, figured at normal conditions, is shown in figure No. 25. The heat loss from a brick wall 18 inches thick, without insulation, is approximately 853 B.t.u. per square foot per hour. By the application of 3 inches of a suitable high temperature insulation the loss is reduced to 388 B.t.u. per square foot per hour. This shows an efficiency of 54.4 per cent. The decided advantage of the water-cooled wall, from the standpoint of heat transmission, is illustrated by the lower section in figure No. 25. With this type of construction the loss is cut down to approximately 54 B.t.u. per square foot per hour. Comparing this with the loss through the original 18-inch bare brick wall, it will be seen that it has an efficiency of over 96 per cent.

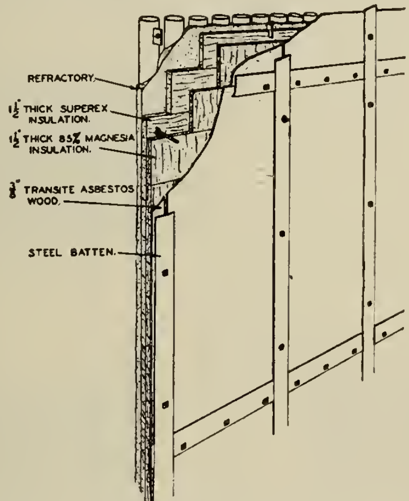

Figure No. 26.—Cut-away Prospective of Recent Type of Water-Cooled Wall.

Figure No. 26 is a cutaway perspective drawing giving an idea of the construction of one of the recent types of water-cooled walls, and is the same wall as shown in section in figure No. 25. There have been various other types of walls developed, each of which offers a slight change in design of the method of insulation, but, in the main, the basis for these is as illustrated in the preceding outline.

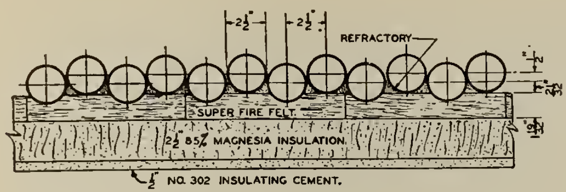

Figure No. 27.—Type of More Rigid Insulation.

This type of wall may be so constructed in panels that it is easily removable and replaceable, should such procedure be necessary. Instead of the so-called asbestos wood, steel casing is often used.

Another type of insulation, which is more rigid, is shown in figure No. 27. It is applied to locomotive fireboxes. The tubes are placed very close together, slightly staggered. The insulation is hard and strong in order to withstand the vibration of a locomotive.

Air-Cooled Brick Walls for Furnaces

In some cases it may still be advisable to have at least a part of the furnace walls of brick, and a discussion on the development in boiler furnace design would not be complete without mentioning the newest designs of air-cooled brick walls for furnaces.

From the many arrangements might be mentioned the air-cooled walls as built by the American Arch Company and called type " C." As compared with the solid brick

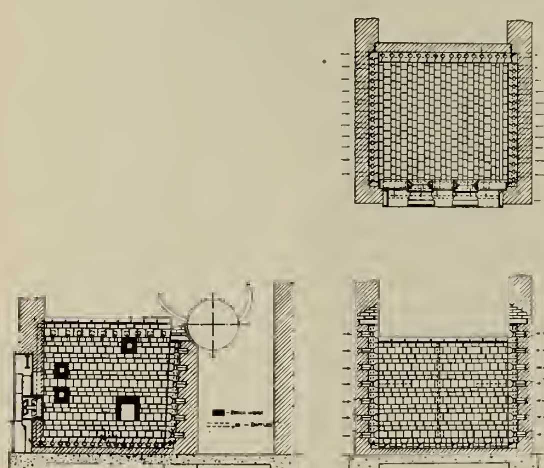

Figure No. 28.—Application of Air-Cooled Wall to Oil-Burning Furnace.

wall it has two distinct advantages. The fire face of the wall is prevented from reaching the softening point by constantly circulating air, so that the clinker adhesion is materially reduced and such clinker as forms is easily removed. In addition, the heat units picked up by the circulating air, and which would be lost otherwise, are available in the form of preheated air for use in aiding combustion. Figure No. 28 shows the application of this type of wall to an oil-burning furnace. The air is being admitted through the side walls of the furnace and after circulating through the side walls it is admitted into the burner register.

Of particular interest is the application of this type of wall to boiler furnaces using pulverized coal. It is applied to the side walls and bridge wall of the furnace. The air is admitted through a series of openings into the air space of the hopper and separate openings are provided for the admission of the air to the side walls. The outlet at the top of the front wall is connected to the inlet side of the pulverizer. In this particular case the preheated air is also used for drying the coal.
ings are provided for the admission of the air to the side walls. The outlet shown at the top of the front wall is connected to the inlet side of the pulverizer. In this particular case the preheated air is also used for drying the coal.

Figure No. 29 shows the application of the type " C " wall to a Taylor stoker. Near the furnace, carborundum blocks are used in order to prevent erosion of the wall at this point.

Another application of this type of wall to a boiler furnace burning pulverized fuel is shown in figure No. 33. The boilers are set in a battery. The air in the centre wall and the side wall is being admitted through vertical ducts and discharges to ducts under the floor. This furnace is also provided with a bottom screen and rear wall, while the side walls are air-cooled.

As mentioned at the beginning of the paper, one of the difficulties of brick walls in modern large boilers with high furnaces is that the weight on the lower part of the wall is too great, particularly when the material becomes rather

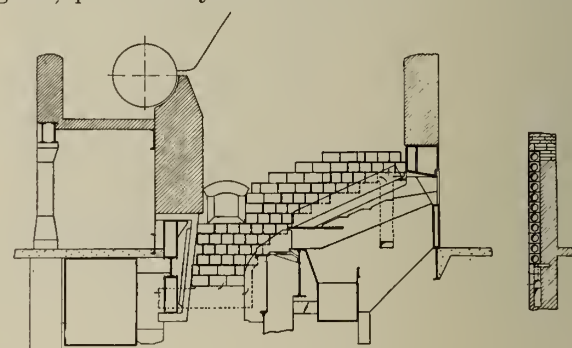

Figure No. 29.—Application of Type "C" Wall to Taylor Stoker.

soft. To overcome this, furnace walls have been developed consisting of sections, each one being held separately by means of cast iron supports. The supporting castings hang freely from horizontal beams so that free movement of the wall required by expansion and contraction is provided for, preventing disintegration from unrelieved pressure. The castings are also adequately protected by the circulating air. Provision is made between the tiles to prevent infiltration of air to the furnace.

Furnace Control

While on the subject of furnaces it may be advisable also to mention the importance of furnace control. Efforts are constantly being made to cut down two serious sources of waste; incomplete combustion and hot flue gases. Seriously contributing to this source of waste is the mistaken notion that the increase in the percentage of CO_2 always denotes better economy. The truth is that the one best per cent of CO_2 is not the highest attainable per cent. Above a certain per cent, which varies with every furnace and depends upon prevailing conditions, a higher CO_2 rating can only be obtained at the sacrifice of fuel economy by reducing the air supply to a volume insufficient to support complete combustion.

There is one way, and one way only, of determining the one best per cent of CO_2, and that is by taking simultaneously CO and CO_2 readings. CO is a positive proof that incomplete combustion exists, and it must be remembered that burning CO to CO_2 produces more heat than burning carbon to CO.

Concrete Foundations for Poles in Earth

A Consideration of the Design of Concrete Bases for Power Transmission Line Poles

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In the transmission of electric power galvanized steel structures are now generally preferred for lines of importance, and are indeed economically required if the spans are long and if the cables are large. Naturally the structures used vary with their duty, and with the space limitations which are encountered; varying not only in capacity but in type. For lighter lines, and where space for the structure is limited, poles are used. Poles may be roughly defined as structures that are set in one hole, while towers are set in four. The matter of foundations for towers is fairly well understood at present; or if this is not true, it can at least be said that information is available. Data as to bases for poles has been hard to find, particularly in English.

Figure No. 1 represents schematically a pole set in the ground in a concrete base. Probably the pole will be made of four leg angles, parallel all the way to the top arm, laced by diagonals: such a pole carries power from Shawinigan Falls to Three Rivers for the Shawinigan Water and Power Company, although this line has a more unusual base than a mere block of concrete, whether solid or hollow.

There are, in figure No. 1, two loads, one horizontal called P, the other vertical, made up of all dead loads, which will be called G. Now $\Sigma H=0$, so P must be resisted by a uniform earth pressure against the block on the right-hand side. Assume the block square, and say 4 by 4 by 8 feet deep; if P were 4,000 pounds the pressure per square inch would be 4,000 pounds $\div$ (4 $\times$ 8 $\times$ 144) = 0.87 pounds per square inch. This is so small that it is usually ignored in calculations. G, however, is too large and too useful to throw away; if the block were of the size just named it would weigh about 18,000 pounds, and the rest of the construction above might weigh another 6,000 pounds under those conditions which give the maximum P. If one assumes that the pressure on the base, which is equal to G, is so applied as to be 0 at one edge and a maximum at the other, then the moment of the couple between G and the vertical earth reaction under the base is $G\frac{b}{6}$. This couple may, however, be greater, and would doubtless be greater long before failure.

This maximum moment between G and the corresponding force provided by the earth under the sole of the concrete block may readily be found. In figure No. 2 a square base of side b is shown, the triangle with the maximum pressure p showing the force area, and the shaded portion showing its application. G is of course applied at the centre of the base. Hence $M=G\left(\frac{b}{2}-x\right) = \frac{3bpx}{2}\left(\frac{b}{2}-x\right)$ and $dM = 3\,b - 12x$. Whence $x = \frac{b}{4}$. And the maximum

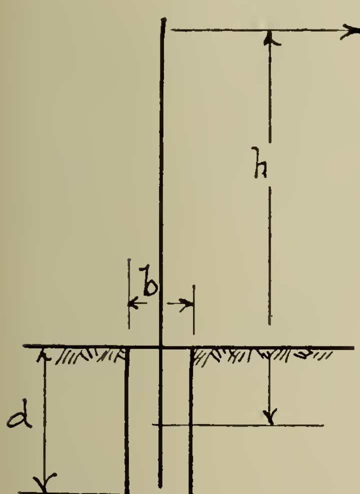

Figure No. 1.

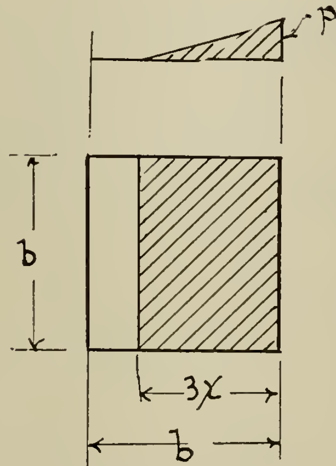

Figure No. 2.

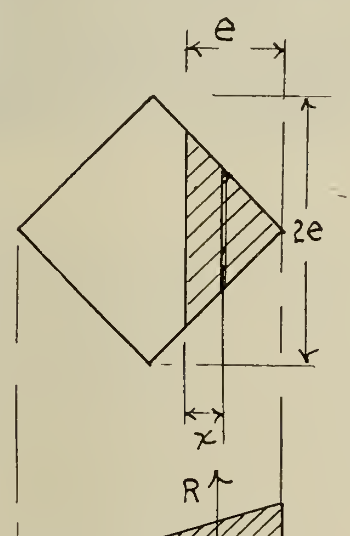

Figure No. 3.

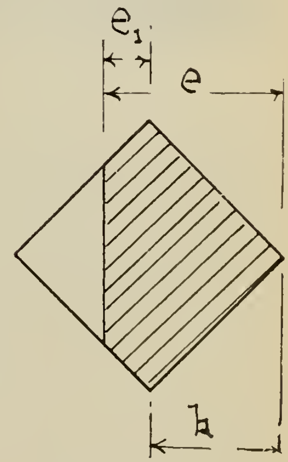

Figure No. 4.

$M=G\frac{d}{4}$, which is 50 per cent greater than the result from the assumptions of the paragraph next above.

If P is at 45° with the direction assumed above the reaction on the base will be somewhat as shown in figure No. 3, and R will again form a couple with G. From the figure $R=\int_0^e \frac{x}{2}\cdot p\cdot 2\,(e-x)\,dx$. Whence $R = \frac{pe^2}{3}$.

Also $M=\int_0^e \frac{x}{e}\cdot p\cdot 2\,(e-x)\,dx$. Whence $M=\frac{pe^3}{6}$.

Further, if $\bar{x}$ = distance to the centre of gravity of the stress volume in question, $\bar{x}=\frac{M}{R}=\frac{e}{2}$.

If a shaded bearing area like that of figure No. 4 be the

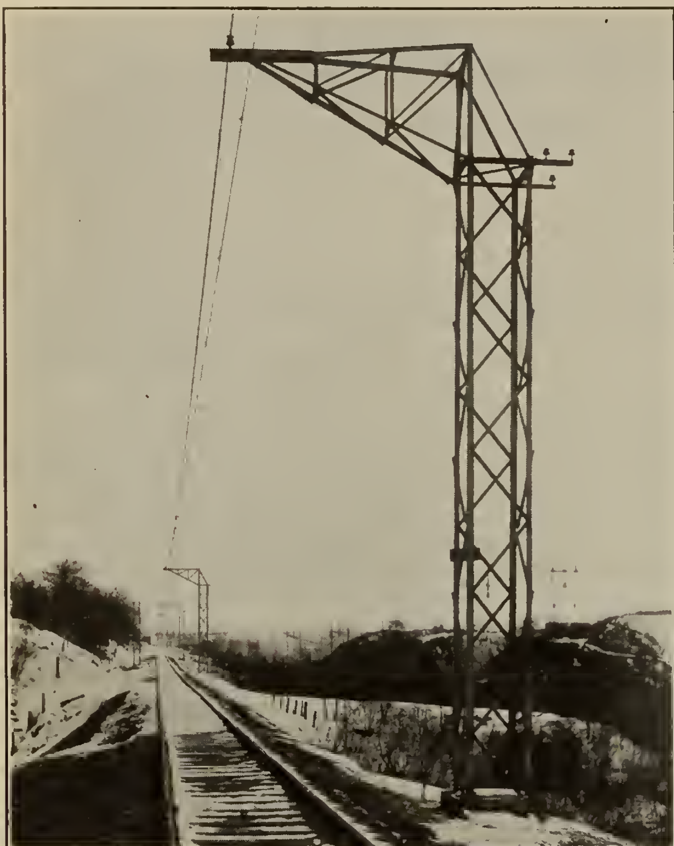

Figure No. 4a—Railway Electrification Pole.

assumed bearing area $R = \frac{pe^2}{3} - \frac{2}{3}e_1 - \frac{e_1^2}{e}\,p = \frac{p}{3}\left(e^2 - 2\frac{e_1^3}{e}\right)$

and $M = \frac{pe^2}{3}\left(h - \frac{e}{2}\right) - \frac{2}{3}\frac{pe_1^3}{e}\frac{e_1}{2} = \frac{pe^2}{3}\left(h - \frac{e}{2}\right) - \frac{1}{3}\frac{pe_1^4}{e}$.

The distance of the centre of gravity of the stress volume from the line of zero pressure is,—

$$\bar{x} = \frac{\frac{pe^2}{3}\frac{e}{2} - \frac{2}{3}\frac{e_1^3}{e}\,p\,\frac{e_1}{2}}{\frac{p}{3}\left(e^2 - 2\frac{e_1^3}{e}\right)} = \frac{\frac{e^3}{2} - \frac{e_1^4}{e}}{e^2 - 2\frac{e_1^3}{e}}$$

The lever arm of the couple formed by G and R is obviously equal to $\frac{P\,h}{G}$, reference being had to figure No. 1, when the pressure on the sides of the block is ignored, as some regulations used to require.

To get the maximum moment with a given maximum p one may proceed as follows, referring to figure No. 5.

$$R = 4\,x^2\,\frac{p}{3}$$

$$M = 4\,x^2\,\frac{p}{3}\,\left(\frac{\sqrt{2}}{2}\,b - x\right)$$

$$d\,M = \frac{4\sqrt{2}}{3}\,bpx - \frac{12}{3}\,px^2 = 0$$

Whence $2x = 0.943b$.

This shows that the shaded area extends $0.236b$ beyond the center line, approximately. Approximately is put in because the above proceeding is extremely reprehensible, academically. The actual distance is about $0.2b$ as determined by trial, and the error involved is less than 1 per cent. The academically correct solution is mighty complicated, and since the influence of the subtractive triangles is very small, the above proceeding, which gets the practical solution, will perhaps pass muster. Anyway, we learn that the maximum moment from G and R taken cat-a-corners is about 74 per cent of the maximum moment on the square.

It is clear that when the base block commences to tip there will be an area of pressure P_2 on the upper right side and another P_5 upon the lower left. Their shapes will be discussed later. It seems clear, however, that if the left side moves upwardly, which it will tend to do, it will meet a downward reaction on a wedge of earth between the side of the block and a plane passing through the left edge of the base and making an angle of 30° with the vertical. Somewhat extended experiments at the Shiffler plant of the American Bridge Company, and elsewhere, have shown that if a grillage is pulled up out of average earth appreciable movement occurs at a pull which corresponds to the inclusion of the weight of earth within a truncated pyramid formed by the grillage and by four planes through its edges and making an angle of 30° with the vertical; it is for this reason that 30° is selected; and a discussion about the angle ϕ avoided.

Now it will be noted that, in figure No. 6, P_2 and P_5 are shown normal to the sides of the block, and this is of course incorrect unless G is taken as including all the earth weight included within its base and four planes through the base edges, and making an angle of 30° with the vertical. It

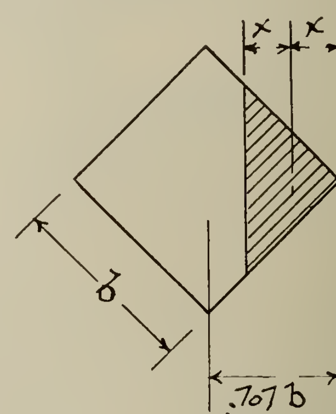

Figure No. 5.

seems not unreasonable to do this, and to leave P_2 and P_5 pointing as in figure No. 6. If one does not like this idea, G need not be made any larger than is desired; and the error will be on the safe side.

Rankine says, Article 200, Applied Mechanics, that if a plane surface presses sidewise against earth the maximum resistance is,—

$$P_v = \frac{wx^2}{2}\;\frac{1 + \sin\phi}{1 - \sin\phi}\text{ per unit of width,}$$

where w = weight
x = depth
ϕ = angle of repose.

For 30° this gives $\frac{3}{2}wx^2$. For 8 feet depth this gives say, $\frac{3}{2} \times 100 \times 8^2 = 9600$, or 2400 pounds per square foot at the base, which the above referred to experiments do not appear to check, since 60 pounds per square inch $\times$ 144 = 8640 pounds per square foot.

For a depth of 2 feet the Rankine formula gives a result which experiments made by digging a trench and pulling a block against the earth by a rope led through a slot in the earth seem to prove ridiculous; values in some experiments in

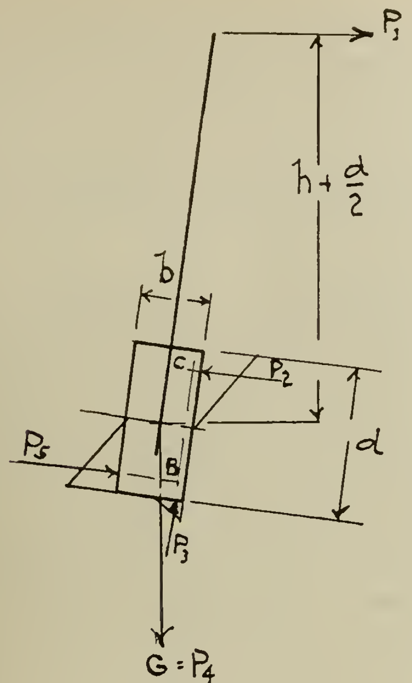

Figure No. 6.

Winnipeg on poor soil near the surface gave 30 to 60 pounds per square inch. If earth were an incompressible homogeneous mass, granular and without cohesion,—which it is not —doubtless Professor Rankine's formulae, all honour to him, would be more useful in the present case. Earth pressure theories assume the surface of rupture to be a plane, the point of application to be two-thirds of the way down, the line of the resultant to make a definite angle with the horizontal; all these assumptions have been questioned.

From the above remarks about earth the following simple rules for our guidance may be inferred, remembering always and indeed first, the tests. First, ordinary average earth increases in available pressure as the depth increases; it is at least 60 pounds per square inch at the depth of a very few feet, and it is decidedly greater at greater depths; probably it is well over 90 pounds per square inch at 8 feet. Second, 30° may be safely taken for the much described planes including an influence volume of earth. Third, the top six inches, or even one foot of earth may be regarded with some suspicion; and, if it is desired to be cautious, it may be assumed in the calculations that this top six inches of earth, or more, is not there at all. If muskeg is encountered it will certainly be necessary to be cautious; and if it is deeper than a foot or two, safeguards should be added, or the scheme of things changed entirely.

Referring to figure No. 6, it remains to discuss the moments from the loads P_2 and P_5. Assume the block to be but slightly tipped. Taking moments about B, and letting $M_1 = P(\frac{d}{2} + h)$.

$$M_1 + (P_1 \times \frac{d}{3}) = \frac{2}{3}\, d\, P_2 + M_4 \qquad (1)$$

Taking moments about C

$$M_1 - (P_1 \times \frac{d}{3}) = \frac{2}{3}\, d\, P_5 + M_4 \qquad (2)$$

Combining (1) and (2)

$$P_2 = P_5 + P_1 \qquad (3)$$

Note that equation (3) follows from $\Sigma H = o$

Taking moments about the centre of the block

$$M_1 = P_2 \frac{d}{3} + P_3 \text{ (say) } \frac{b}{4} + P_5 \frac{d}{3} \qquad (4)$$

$$= \frac{2}{3}\, d\, P_5 + P_1 \frac{d}{3} + P_3 \frac{b}{4} \qquad (5)$$

$$\text{or } P_3 \frac{b}{4} = M_1 - P_1 \frac{d}{3} - \frac{2}{3} P_5\, d \qquad (6)$$

Equations (4) to (6) assume that the earth so crushes under the heel of the block that the maximum moment from P_4 remains a constant, and consequently that the lever arm of P_3 is $\frac{b}{4}$. As the maximum-minimum curve is for some distance very slow in its changes, and as the earth unquestionably will compact if overloaded, it is thought that these are reasonable assumptions.

$$\text{From (6)} \quad \frac{2}{3} P_5\, d = P_1 (h + \frac{d}{6}) - \frac{b}{4} G \qquad (7)$$

from which P_5 may be found, P_2 being found from (3).

The above is given in some detail because it is similar to, although different in results from, the calculations of page 35 in Froehlich, Beitrag zur Berechmung von Mastfundamenten 1921, upon which book present German practice is said to be based. It is, however, rather a useless performance, as its results are more easily obtained by assuming $G = P_4$, forming a couple with the assumed lever arm $\frac{b}{4}$; finding the moment for the couple P_2 and P_5 by subtracting the moment from G and P_4 from M_1; solving for $P_5 - \frac{P_1}{2}$, and adding P_1 to the result to give P_2. And when we have done all this, the results are wrong. Consider that this gives a maximum P at the top, which is absurd, either by common sense, or by Rankine's formula as to P increasing with the

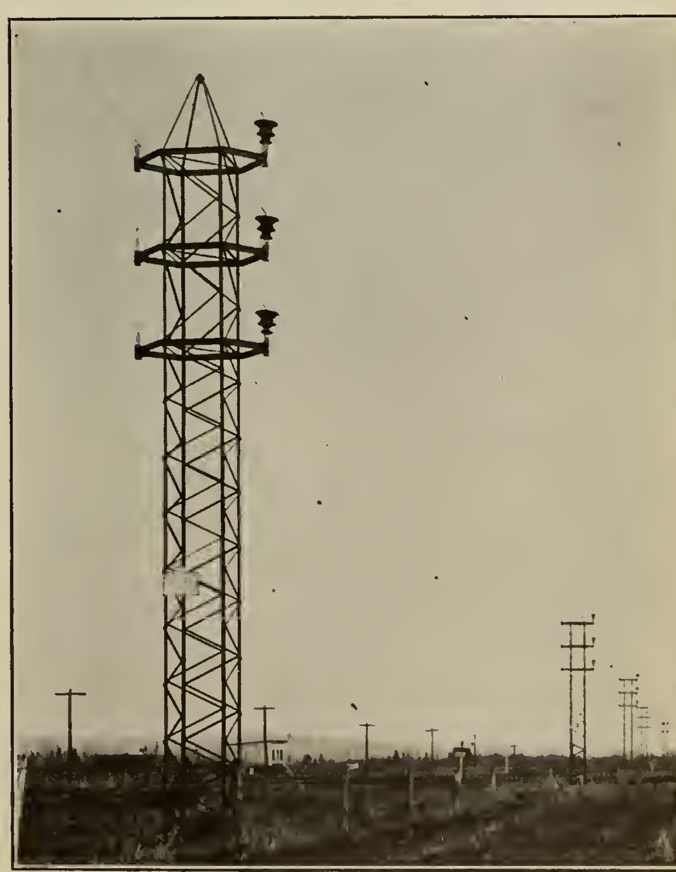

Figure No. 6a.—Quebec Square Pole used by the Shawinigan Water and Power Company.

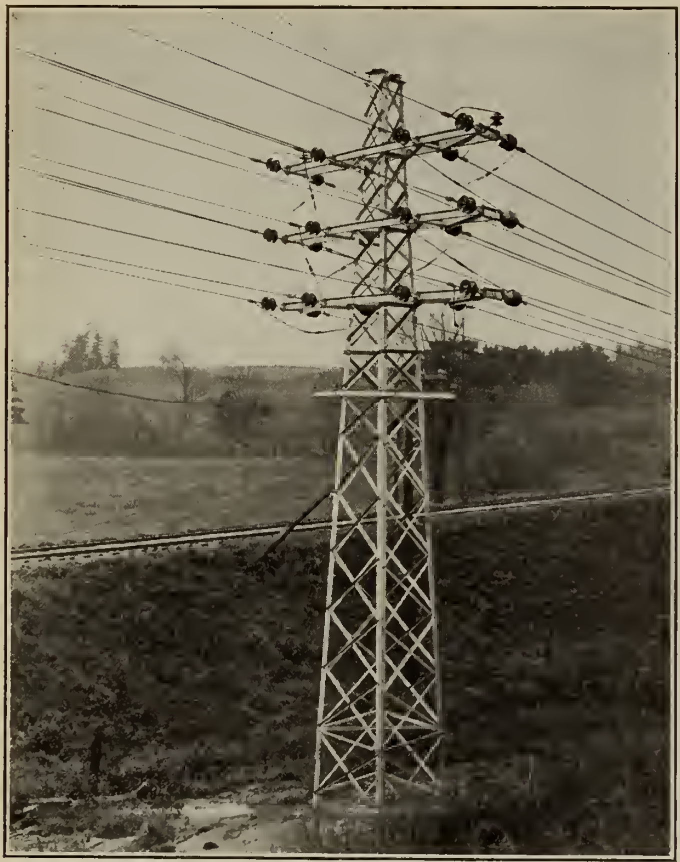

Figure No. 7a.—Transposition on Anchor Tower—Hydro-Electric Power Commission of Ontario.

depth. So the turning point cannot be at the centre of the block.

Engels reported in 1903 various experiments on rods set in sand and loaded at the top with a horizontal load, as sketched in figure No. 7. As P was increased the flexible rods bent, but the base stayed as shown in figure No. 7; eventually, as P was further increased, a turning point 0, figure No. 8, developed, which became gradually higher until it found a resting-place, about which either the rod turned out of its sand setting, or broke. Engels fixed the critical point at the moment when the base of the rod started to move, and the point of turning O made its appearance.

On this basis Mohr opined that a theory might be based, as thus: "The unit pressure P is undoubtedly zero at A (see figure No. 9), reaches a position maximum at B, is again zero at G, and below C is negative. The simplest assumption is that the resulting pressure curve is a parabola." Apparently the rods started to move at the bottom end D when the pressure at this point equalled the passive earth pressure minus the active earth pressure; which is an argument on a hydrostatic analogy, and not necessarily correct or incorrect.

Mohr, Ullmann, Kapper, and doubtless others, consider that the top pressure area is a parabola, as indicated in figure No. 9; Krey, Foerster, and doubtless others, consider the top pressure area as a triangle, as indicated in figure No. 6. Froehlich does not care which it is, being content with either assumption. Nobody desires to call the bottom pressure area anything else than a triangle.

Most of these discussions assume the block to be a flat plate, or slab of negligible thickness, which of course it is not. As the block tends to move it develops friction on the sides parallel to the movement. It seems not unreasonable to assume that this feature is sufficiently considered, for rough work like this, if G has included in its calculation the earth within the 30° planes already discussed above.

The moment of P_2 and P_5 (which really is more properly $P_2 + \frac{P_1}{2}$ and $P_5 - \frac{P_1}{2}$) is for the triangle arrangement of figure No. 6, neglecting P_1, which does not amount to much in most cases. $M = \frac{pbd}{4} \times \frac{2}{3} d = \frac{1}{6} pbd^2$, from which it will be noted that this important moment of resistance increases directly with the breadth and with the square of the depth. This assumes the same p at top and at bottom, which is convenient although untrue.

If the assumptions of pressure areas are in figure No. 9, neglecting P_1 as before, and assuming the point C as one-third up from the base, which may be considered fairly true in view of tests of Engels and Froehlich, we may write from the parabola,

$$M = \frac{2}{3}p\ \frac{2}{3}d\ b \times \frac{5}{9}d = \frac{20}{81}pbd^2 \qquad (1)$$

or from the triangle

Figure No. 7.

Figure No. 8.

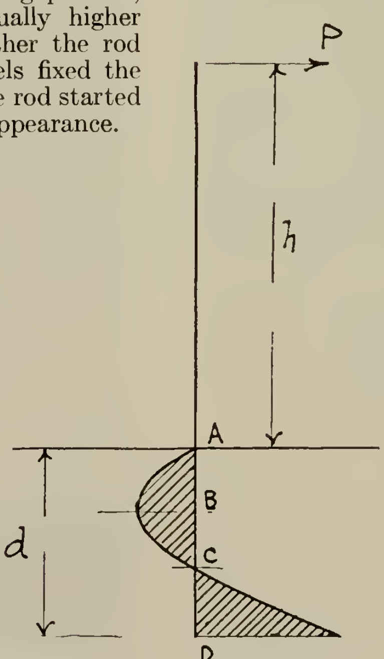

Figure No. 9.

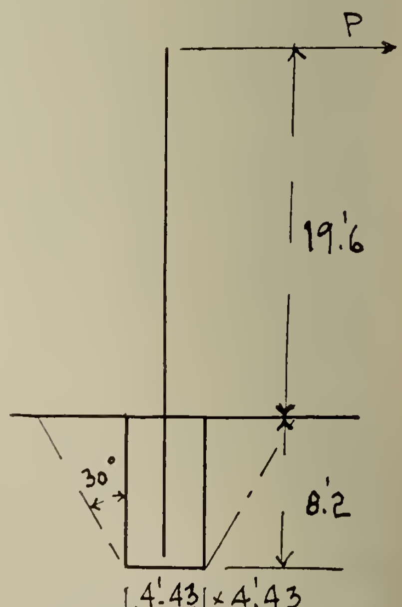

Figure No. 10.

$$M=\frac{1}{2}p\ \frac{1}{3}d\ b\times\frac{5}{9}d=\frac{5}{54}pbd^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

This means that if equation (1) is used, the pressure at the bottom is $\frac{8}{3}$ of the pressure at the centre of the parabola, which is probably too much.

Froehlich in his book, cited above, reported a series of tests which put to rout the ancient rules of the various official bodies, and introduced sensible footings. These tests were carried out for Siemens Schneckert, the Post Verwaltung, and others. Unfortunately most of the block bases had bottoms much larger than the tops of the blocks, but these were approved by Froehlich. Dr. Ing. H. Doerr (as quoted in Foerster), in his "Die Standsicherheit der Masten und Waende in Erdreich," 1922, said the foundation blocks should be made as deep as necessary, and only as wide as necessary. This would result in the usual case in a square block of modest size extending to a relatively immodest depth. This, he explains, results from the moment of resistance varying as the square of the depth. It is pleasing to note that this corresponds with both Canadian theory and Canadian practice of some fifteen years' standing.

In test IX cited by Froehlich, these are the conditions given in figure No. 10. Loose earth as dug weighed 94.3 pounds per cubic foot, packed 135 pounds per cubic foot; loose, dust-dry earth weighed 91 pounds per cubic foot, packed 113 pounds per cubic foot. The slope was 34° for earth as dug. The block was pulled through an angle of 0.9° when P was 5730 pounds; 2.2° when P was 7230 pounds; 3.0° when P was 8400 pounds, and 12.7° when P was 16,000 pounds.

In the 98 inches of block depth, if the bottom is assumed not to have moved at all, the top would have moved, for $P=$ 5730 pounds, a distance of 1½ inch; at this time the moment would be 5730 × 23.7 = 136,000 foot-pounds. The last loading of 16,000 pounds for P gives a moment, on the same assumptions, of 380,000 foot-pounds.

The weight G exclusive of earth within 30° planes must have been somewhat more than 25,000 pounds; with such earth included, say about 80,000 pounds.

Neglecting everything but the two couples P_2 and P_5 (which are assumed equal), and G and P_3 (see figure No. 6,) several solutions may be tried.

(1) Assume P_2 and P_5 to have equal p's = 30 pounds per square inch, and each P to extend over the half depth. Assume G and P_3 to have an arm of $\frac{b}{4}$.

M from $G=80{,}000\times\frac{4.43}{4}=$ ....88,500 ft.-lbs.

which is not to be used without thought.

ft.-lbs.

M from $P_3=\left(30\times144\times4.43^2\times\frac{3}{4}\times\frac{1}{2}\right)\times\frac{4.43}{4}=$ 35,000

M from P_2 and $P_5=\frac{30\times144\times4.43\times4.1}{2}\times\frac{2}{3}\times8.2=$ . . 214,000

249,000

(2) Same as (1), but assume top foot of earth inactive, for M sidewise.

ft.-lbs.

M from $P_3=$ 35,000

M from P_2 and $P_5=\frac{30\times144\times4.43\times3.6}{2}\times\frac{2}{3}\times7.2=$ . . 165,000

200,000

(3) Assume parabola and traingle for P_2 and P_5 respectively; assume p as 40 pounds in triangle; assume 0 stress at $\frac{d}{3}$ from bottom;

ft.-lbs.

M from $P_3=$ 35,000

M from $P_5=\frac{40}{2}\times144\times4.43\times\frac{8.2}{3}\times\frac{5}{9}\times8.2=$ 159,000

194,000

(4) Same as (3) assume $p=30$ pounds and figure from P_2

ft.-lbs.

M from $P_3=$ 35,000

M from $P_2=\frac{2}{3}\times30\times144\times\frac{2}{3}\times8.2\times4.43\times\frac{5}{9}\times8.2=$ . . 318,000

353,000

When P at base $=30\times\frac{8}{3}=80$ pounds per sq. in., and M from P_3 could probably be changed to correspond.

Many other variations are possible.

It will be obvious that greater movement can be permitted in unimportant cases than when, for instance, two dead end poles carry a transmission circuit across some important structure without large clearance. It will also be evident that slow long-continued pressure is required to make earth give way when only modestly overloaded; gusts of wind may properly be carried at earth pressures which would be ridiculously high if used for buildings.

Foerster, "Die Eisenkonstruktionen des Ingenieur-Hochbaues," 5th edition, 1924, p. 237, recommends the procedure of example (1) above, omitting the moment from G or P_3, and using $P=43$ pounds per square inch, with this addition: "In accordance with the degree of safety desired ....will the resulting depth be increased by generally about 50 per cent, in especially difficult cases even 100 per cent." Thus he would increase the figured capacity of example (1) above to about 308,000 foot-pounds, and then call it worth only 137,000 foot-pounds, or in especially difficult cases, (whatever that means), 77,000 foot-pounds.

It is believed that it would be wise for anyone building many bases of the type discussed to try two or three, or if this is too much trouble, at least to dig a little trench and pull a wood block against the side of the trench by a cable to the middle of the wood block; the cable being in a slot out in the earth for its reception. A dynamometer in the cable will give the pressure on the earth, and probably will give a fairly comforting result.

Other types of pole foundations are possible, and some of them have been used. These and some possibly not uninteresting figures as to wood poles in earth are not discussed here.

The writer prefers (1) and (2), in which 30 pounds per square inch is used, possible overload being indicated by 60 pounds per square inch considered as failure; see the results of test IX, Froehlich, referred to above. In deep footings it would be well to use two triangles and different p's. The results from (4) are based on 80 pounds per square inch at the heel, and are not far from right, since the base of test IX by Froehlich actually carried 380,000 foot-pounds, and since earth near to the surface will carry many times the extreme load indicated by Rankine's formula, and the point of zero pressure is not far from right.

It is believed that a pull at 45° with the pull figured in (1) to (4) above would not differ greatly in its results with the pull square to the block; so it seems, at least, from the Froehlich experiments.

Discussion of Paper on Electrical Characteristics of Quebec-Isle Maligne Transmission Line, by Prof. C. V. Christie, M.E.I.C.*

Mr. W. S. Lee, m.e.i.c.

Mr. Lee enquired whether lightning arresters were used on the Quebec-Isle Maligne line, and asked further whether obtaining additional space for the ground wire by extending the top arm added any weight to the tower on account of torsion.

Prof. C. V. Christie, m.e.i.c.

The author stated that it was not proposed to use lightning arresters, and asked Mr. Goodrich to answer the second question.

Mr. C. M. Goodrich, m.e.i.c.

Mr. Goodrich replied that there was an increase in weight, although not an important one. There had been a tendency to increase the offset of the middle arms; some operating men being well content with even less than two feet, while some required as much as five. There was an interesting case in the west where the wires were originally directly over each other in a double circuit 220,000-volt line where a relatively small offset was secured by adding a second string of insulators on the middle arm. This had rendered operation satisfactory. Sleet was certainly the chief reason for offsetting.

Mr. W. S. Lee, m.e.i.c.

Mr. Lee remarked that there was more sleet trouble in North Carolina than in Quebec. The sleet came on at a critical temperature, when it was not so cold, and the rain and slush piled up on the conductors. In 1908 when the first 100,000-volt line was built, the conductors had been spaced over one another. The first sticky soft snow storm covered all the insulators, and the wires got about as big as a man's wrist, but the line operated perfectly. That storm happened in the early morning, and about three in the afternoon there were not operators enough on the system to keep the switches closed as fast as they opened. It had taken two years to find out what the trouble was, as such storms did not occur very often. When the conductors became heavily loaded with ice or sleet and the thaw began they generally had an unequal unloading. With a vertical spacing of 10 feet 4 inches, he had known the conductors to touch from that cause, as the ice was thawing off the line. This had been avoided by extending the middle arm out three feet.

With regard to ground wires, he had never had a pole on a wood pole line destroyed by lightning when the conductors were strung, although three cases had occurred during his experience in which lightning had shattered poles before the conductors were placed; therefore, he believed in using the ground wire. Steel tower lines were not subject to direct strokes of lightning like wood poles.

Mr. J. G. Glassco, m.e.i.c.

Mr. Glassco observed that the paper on the Quebec-Isle Maligne Transmission Line, while quite brief, contained practically all the information of real value to other engineers who desired to keep themselves familiar with current engineering thought and design on work of that type.

There were two features, however, which might have been expanded, since so many engineers were interested in the assumed minimum stresses in transmission tower steel, and the reasons for adopting any particular class of conductor loading, such as three-quarters of an inch of ice and ten-pound wind. It was his belief that engineers were becoming a little more generous than heretofore when making safety factor allowances for transmission lines; a very natural course in view of the large blocks of power for which transmission line circuits are now made responsible.

The 900-foot span adopted was another proof that engineers were likely to adopt, in the near future, a standard transmission line span which would not differ more than 15 per cent from the 800-foot span which has now become so popular with tower designers.

Prof. C. V. Christie, m.e.i.c.

The author in reply said that Mr. Glassco's question dealt with one of the mechanical difficulties upon which he had not touched in his paper. The fact that this line was built in a territory where conditions were more or less unknown, and that it was such an important line, had led to the use of a higher load and a slight increase in the factor of safety. The normal span adopted was 900 feet on the new line; on the old line, it was 550 feet. There was no doubt of the greater economy of the longer span, and for these heavier towers 900-foot spans seemed reasonable. Longer spans could be built, but he thought it well for engineers, in cases of very important lines, to go slowly and not to increase the span beyond what was necessary.

Discussion of Paper on Alternating Current Electrolysis, by Prof. J. W. Shipley and Chas. F. Goodeve.†

Mr. F. T. Kaelin, m.e.i.c., and Mr. H. W. Matheson.

Mr. Kaelin observed that the authors had established the fact, through a great number of experiments, that the generation of gases is a function of the current density of the alternating current, which confirmed the contention of Mr. H. W. Matheson and himself, as expressed in the discussion of the paper last year. The authors, however, had dealt only with voltages up to one hundred and ten and with temperatures up to approximately the boiling point of water. Three to four years ago, he and Mr. Matheson carried out a great many experiments in a glass boiler, utilizing various types and shapes of electrodes and a variable voltage transformer, so that voltages could be obtained up to and above the arcing point under definite conditions of water conductivity and spacing of electrodes. This glass boiler was covered so that the non-condensable gases could be recovered and analyzed. Two electrodes were suspended in the boiler, one being at high voltage and the other grounded. Water of a definite conductivity was utilized and distilled water was added to maintain a constant level and conductivity of the boiler water. Numerous experiments were carried out with this boiler, and the results, as far as

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non-condensable gases were concerned, were impossible of explanation by the theory advanced by Prof. Shipley and Mr. Goodeve. For the sake of explanation, he would give the results of a few experiments. For these electrodes were used consisting of one-half inch steel bars immersed in the boiler to such a depth as to give one and three-quarter square inch effective electrode area. The solution employed was 0.0028 per cent sodium carbonate, having a resistance of one hundred and ninety to two hundred ohms, as compared with raw St. Maurice river water of three hundred and forty-two ohms. The experiments were carried out at the boiling point, the water and gas being collected over a definite period of time.

volts above the arcing point, the arcing point in this case being at two thousand volts; but just below the arcing point the same results were obtained, namely, from one and a half to four parts of hydrogen per million of steam. This had been found to be true in all experiments carried out,—that just below the arcing point the gas averaged from one to four parts per million of steam, whereas just at and above the arcing point the hydrogen increased at a very rapid rate.

This general conclusion had been verified by analyzing the gases produced by a small laboratory boiler operated at one hundred pounds steam pressure. It had furthermore been verified by the analysis of the non-condensable gases from large industrial installations. In large boilers which

Run No.	Electrode		Arcing Condition	Approximate Value					
	Kind	Area Sq. in.		Voltage	Amperage	Power Factor	Water Collected CC.	H_2 pts. per million of steam	Resistance ohms
9	½ inch rod	1.75	500 volts above arcing point	2300	1.06	90.1	2825	209.0	200 to 197
10	½ inch rod	1.75	Just arcing	1990	.94	96.3	2730	44.2	207 to 197
11	½ inch rod	1.75	Just below	1700	.81	96.0	2050	3.7	210 to 207
12	½ inch rod	1.75	280 volts below arcing point	1520	.80	95.0	3650	1.86	210 to 200

For the sake of completeness, the details of run No. 9 were given as follows:—

Run No. 9—Carried out well above arcing voltage.

The data for the run is as follows:—

Electrolyte ....0.0028% Na_2CO_3.
Resistance at start.......220 ohms.
Resistance at end........197 ohms.
Time ....1 hr. 15 min.
Average voltage ....2300.
Average current ....1.06 amps.
Average input ....2.44 kv.a.
Power used ....2.2 k.w.
Power factor ....90.1%.
Gas collected ....1215 cc. at 16°C. and 765.7 mm.
Water collected ....2825 cc.

Analysis of gas:

CO_2=0.31% of 1215=3.76 cc.=3.52 cc. dry gas at NTP.
O_2=28.2% of 1215=342.5 cc.=320.5 cc. dry gas at NTP.
H_2=64.8% of 1215=787.0 cc.=736.0 cc. dry gas at NTP.
N_2=6.8% of 1215=82.5 cc.=77.2 cc. dry gas at NTP.

It would be observed in this experiment that the amount of hydrogen collected was actually 736 cc. measured at normal temperature and pressure; the amperage was 1.06, and, if all the current had been utilized for making hydrogen and oxygen, one ampere-minute would have given 6.28 cc. of hydrogen gas, or 1.06 amperes for 75 minutes would have given a total of 518 cc. of hydrogen, whereas that actually obtained was 736, or 144 per cent of that theoretically possible if all the current were utilized to produce hydrogen gas. He considered it difficult to explain this phenomenon unless it were assumed that there is thermal decomposition of the water at the temperature of the arc.

In run No. 10, thirty-two and a half per cent of hydrogen was obtained, as compared to what would be possible if all the current produced hydrogen and oxygen, and this experiment was carried out just above the arcing point. In run No. 11, in the same way, 1.8 per cent was obtained, and in run No. 12, 1.06 per cent.

The same experiments duplicated, utilizing St. Maurice river water, concentrated to give the same conductivity as 0.0028 per cent sodium carbonate, gave somewhat different results, the hydrogen being somewhat less at five hundred

were improperly designed, or operated with impure water of high conductivity, arcing was audible in the boiler and the hydrogen in the non-condensable gases was very high. In boilers properly designed and operating in water of the desired conductivity, no arcing took place and the hydrogen produced was approximately the normal amount. Arcing in all cases was accompanied by high amounts of non-condensable gases, hydrogen and oxygen. As soon as the arcing ceased, these gases were reduced to normal. It was impossible to record details of these results at this time.

As previously pointed out, therefore, (see Engineering Journal, April 1926, p. 198), in the construction of a high tension electrode for an electric steam generator it was very important that the design should be such that as uniform a current density as possible should be maintained over the whole area, and the average should preferably be under three-quarters of an ampere per square inch. He would say that current density, however, is only an important factor in the production of objectionable amounts of hydrogen and oxygen when on localized areas a current density is reached where arcing commences. The conditions producing arcing, however, in the electric boiler depended upon many other factors outside of the design of the boiler itself.

The phenomenon of arcing under water under these conditions possessed some peculiarities. In the above cited experiments the rods were parallel to one another at eight inches apart; the arcs did not strike between or towards the other electrode, but directly downwards into the water. If horn-gap electrodes were used, for example, consisting of one-inch bars curved outwards away from each other at the lower end, the arcing would take place at the outer end, the arc striking horizontally away from the other electrode. This was merely one of the peculiar phenomena accompanying arcing at higher voltages and was undoubtedly due to some electro static effect.

With reference to the design of boiler as indicated by Prof. Shipley, their experience, extending over several years, and experiments with and the designing of new boilers, would show that such a design is completely impractical. Insulation of any kind beneath the water surface should be avoided, as it merely became coated with impurities, and resulted sooner or later in a complete breakdown due to a short circuit. Even with the design such as the authors had outlined, and utilizing the voltages which are common for commercial boilers, the current density would not be at all uniform over the surface, and there would be greatly increased current density at the base of these electrodes. This had been shown by Mr. Matheson and himself in numerous experiments carried out in glass boilers with the ends insulated in a manner similar to that indicated. All their unpublished experiments had been conducted with the idea of improving the design of the original electric boiler, and the results of these tests had been embodied in an improved design of boiler.

Prof. J. W. Shipley and Mr. Chas. F. Goodeve.

The authors in reply considered that the discussion by Messrs. Kaelin and Matheson showed that in the range of common experimentation their results agree with their own. Outside this common range there was no basis for comparison. The authors had found no production of gases due to arcing up to 110 volts, while they, working with voltages between 1,500 and 2,500, had found that gases in excess of the amount possible by electrolytic decomposition were produced. Below the arcing point they had found, like the authors, that no appreciable amount of electrolytic gases were produced at low current densities. The authors, however, working over a wider range of current density, had found that above a certain critical value all of the current was utilized as if it were direct current in decomposing the water electrolytically into hydrogen and oxygen, quite independently of arcing. This electrolytic decomposition occurred not only on iron and steel electrodes but on nickel, copper, silver and platinum, and resulted in the evolution of large volumes of hydrogen and oxygen at all temperatures up to the boiling point of water. Messrs. Kaelin and Matheson did not report having carried out any experiments at such current densities, and so were hardly justified in ignoring the results of hundreds of experiments by stating that " current density, however, is only an important factor in the production of objectionable amounts of hydrogen and oxygen when on localized areas a current density is reached *where arcing commences.*" (The italics are the authors'.)

Nernst and Wartenberg had shown that steam suffers thermal dissociation of only 0.00003 of one per cent at 1,000°C, and 3.98 per cent at 2,500°, at atmospheric pressure. Possibly at low voltages the under-water arc had a much lower temperature than that produced at high voltages, and this would account for the absence of gases observed by the authors due to arcing at low voltages.

After many trials, they had found that uniform current density could only be obtained on a cylindrical electrode by carefully insulating both ends. They could not agree with Messrs. Kaelin and Matheson that insulating the lower ends of the electrodes in commercial boilers would greatly increase the current density at the base. From theoretical considerations, and by actual experiments, they had shown that it has the opposite effect. As to short circuiting, due to sedimentation, the flow of incoming water could be made to flush off the sediment from the base of the electrode, or some simple mechanical device could be provided to obviate this objection, as, for example, the use of individual insulators. This was a problem for the engineer, and not the chemist.

The experimental results obtained by Messrs. Kaelin and Matheson must be extremely interesting and valuable, and the authors hoped, in the interests of science and of engineering, that they would be released for publication in full in the near future. Duplication of much work might thus be avoided.

Discussion of Paper on The Water Power Developments of the Alouette-Stave-Ruskin Group, by E. E. Carpenter, M.E.I.C.*

Messrs J. H. Brace, m.e.i.c., and J. A. D'Aeth, m.e.i.c.

Messrs. Brace and D'Aeth remarked that, being chiefly connected with work in central and eastern Canada, where less precipitation and more severe climatic conditions prevailed, it would be interesting, from some studies on the regulated flow of rivers in northern Quebec, to make the following comparison:—

At Alouette a regulated flow of 692 to 910 cubic feet per second was obtainable from a drainage area of 80 square miles with a storage capacity of 170,000 acre-feet or 266 square-mile-feet. This gave a regulated run-off of 8.6 to 11.3 cubic feet per second per square mile of drainage area at the discharge point of the storage. The Quebec storage referred to would give a flow of 10,000 cubic feet per second from a drainage area of 9,300 square miles with a storage capacity of 5,000 square-mile-feet or a regulated flow of 1.04 cubic feet per second per square mile of drainage area. They believed that from data available relating to regulated river flows in the province of Quebec it was generally considered that the limit of regulation is reached if a regulated flow of from 0.8 to 1 cubic foot per second per square mile of drainage area is obtained.

On the Alouette scheme, the plans accompanying the paper did not show the method adopted in making the seal between the concrete structure and the earth dam. It would be interesting to know what special construction or precautions were taken in making this seal.

From an examination of the plans, it would appear that the 9-inch spillway channel lining was rather thin. This opinion might, of course, be more or less influenced by the additional precautions which would have to be taken were this structure built in a locality subject to more severe climatic conditions. They considered the method adopted to deal with the tunnel surge unique and interesting.

In looking at the plan of the Stave Falls development, they were rather surprised at the manner in which the penstock of the fifth unit crosses the old ones instead of being kept on the intake side all the way to the power house. This layout must have been the result of certain operating or possibly topographical conditions which had not been mentioned in the paper. It would be interesting to know about these conditions if such existed. To make additions to old power houses and at the same time keep them operating was, of course, not always an easy problem.

Mr. G. A. Gaherty, m.e.i.c.

Mr. Gaherty observed that in the early stage of development of the Stave Falls project an interesting point had arisen in connection with the natural storage on Stave lake. Several years' records were available for the discharge of the Stave river at a point some distance below the outlet of

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Stave lake. These showed a maximum flood of about 40,000 cubic feet per second, and on this William Kennedy, Jr., M.E.I.C., based his design of the sluice dam. One of the first things the late Mr. R. F. Hayward had done on taking over the management of the Western Canada Power Company, Limited, was to increase the proposed capacity of the plant, and at the same time the crests of the dams were raised some six or eight feet and the sills of the sluices a corresponding amount. Under Mr. Kennedy's design, the upper water level at the dam was about the low water level of the lake under its natural condition.

Subsequent investigation showed that the level of Stave lake had an extreme variation under natural conditions of some fourteen feet. Furthermore, unlike eastern streams, the Stave river varied from almost a minimum to a maximum under autumn flood conditions in less than thirty-six hours. While accurate records of the level of Stave lake were not available during flood conditions, the deduced inflow into the lake during one of the floods of the past was some 80,000 cubic feet per second, the difference between this and the observed out-flow being stored temporarily on the lake.

Under Mr. Kennedy's design, practically the full natural regulation of the lake in floods would have been obtained, but, with the water level raised, it became necessary to cope with most of the in-flow instead, and the sluiceways were no longer of adequate capacity to pass the flood discharge that might, under extreme conditions, be encountered. Unfortunately, by this time the Western Canada Power Company had become financially involved, so that no money was available for expensive remedial works. The method of meeting the situation was, immediately on a flood becoming imminent, to draw down the lake to its natural low water level by opening up all sluices. While he was not familiar with the later history of the Western Canada Power Company, it was his impression that by this means any serious damage was avoided during flood conditions until such time as the further raising of the dams permitted the installation of additional sluice capacity.

He drew attention to this matter since few engineers appreciate fully the great influence which the natural flood regulation of a large lake may have on a stream subject to violent fluctuations.

Mr. H. C. Brown, A.M.E.I.C.

Mr. Brown considered the method of depositing the impervious core material in the Alouette dam particularly interesting, in view of the fact that impervious cores are not always secured, although drawings may indicate nicely their location and approximate dimensions. This applied to canal banks as well as to dams made of deposited material, particularly when really good impervious material was not available. The great care taken in the building of this dam should prevent any trouble from leakage.

He desired to ask the author if any other design of spillway was considered, in view of the expensive mass concrete work used in the toe and cut-off wall.

A cut-off wall 5 to 7 feet thick and 12 to 15 feet deep, the full width of the spillway apron, with wing walls carried back 19 feet to form the "U"-shaped section, and the flexible mattress portion of the spillway with stones having a minimum diameter of 3 feet covering an area of 40 feet by 120 to 145 feet, cabled together and then covered with a 12-inch slab of concrete, must have involved considerable expense.

Mr. A. F. Meyer, consulting engineer of Minneapolis, had written a very severe criticism of this method of constructing the ogee spillway profile on dams to prevent erosion trouble at the foot of the apron, contending that if enough mass concrete is used it is practically impossible to have erosion, but that such mass concrete is often entirely unnecessary. His scheme to absorb the enormous amount of energy in the falling water was to use a hollow bucket or trough instead of the solid curved bucket commonly used, thus duplicating what is found in nature at all large waterfalls.

The line of action of the swiftly moving water over the spillway apron was far below the line of action of static back pressure, and swift under-currents persisted for a considerable distance downstream, hence the prevalence of scour even though the apron had been lowered.

Scour occurred below a spillway structure whenever the excess energy of the overfalling water had not been sufficiently destroyed before that water reached the erodible river bed.

It was a matter of common observation that a jet of swiftly moving water led into a pool of relatively quiet water is quickly robbed of its excess energy. If a sheet of swiftly moving water could be attacked on both sides by slowly moving water, it would be brought under control more quickly than if attacked on only one side. At the foot of every natural waterfall, there was a pool of water, extending well backward under the crest of the fall by the action of the "back eddy" or "blacklash." Swiftly moving water, leaving the bucket of the ogee spillway, might flow with little reduction of energy over an 80-foot apron; but when it began to flow over the water in the pool scoured out beyond the apron, it was quickly slowed up. The most effective way to slow up a moving object would obviously be to attack it with forces whose direction and line of action are opposed to the path of the object.

Mr. Meyer's designs appeared to do this very nicely, since the water leaving the hollow bucket has had the major portion of its energy absorbed and flowed away at low velocity. Mr. Meyer had spent ten years experimenting on erosion trouble on spillways, and he would ask the author his opinion of Mr. Meyer's methods in preventing erosion at the end of spillway aprons.

Mr. Brown was of opinion that the Meyer design of spillway was well suited for backwater conditions at light periods of discharge. He had in mind an expensive crib dam erected to form a pool to absorb the energy of water after erosion trouble made this crib dam a necessity; in that case, it would appear, assuming Mr. Meyer's experimental results to be correct, that a more economical section of the spillway could have been used.

His own experience, covering observation and study of erosion trouble on spillways, led him to believe that a very interesting and profitable discussion could take place on erosion trouble and design of spillways, in view of the apparent repeated mistakes being made in spillway designs.

The large section used for the log chute was very striking as compared with log chutes built in the east, where the timber is, of course, very much smaller.

Referring to the description of the Alouette power station, he noted the statement that "a concrete weir 100 feet long with crest elevation at 314 will control the tail water, the normal low level of which is 316." It would be interesting to know the reason for selecting that particular elevation for this concrete weir, in view of a recent report of the Hydraulic Committee of the National Electric Light Association stating that a survey of 225 turbines tends to show that excessive draught head on turbines is largely responsible for serious pitting trouble on turbine runner blades. A number of plants to-day which were having serious pitting of turbine blades were admitting air to draught tubes and by various other schemes of raising tail water levels were endeavouring to overcome apparent excessive draught heads.

He assumed that no trouble was expected from pitting in this station and that no excessive draught head would be possible with this weir from low tailrace levels. There appeared to be considerable doubt at present as to whether the manufacturers are sure of the point where draught head causes cavitation to take place on the runner blades.

He noted in figure No. 10, showing the penstock for the new No. 5 unit of the Stave Falls power house, that it was necessary to cross the existing pipe lines to connect this penstock with the new turbine. The large radius of curvature should give a low head loss in the elbows, and it would be interesting to know if elbow loss tests had been made on this penstock.

The transformer capacity connected to the new unit appeared rather generous, unless it was anticipated that increased capacity might be secured from the unit.

The sound conservative engineering on all these developments was evident, not only in their description, but in reading between the lines the reasons for certain methods of design and construction.

Mr. T. H. Hogg, M.E.I.C.

Mr. Hogg complimented the author on the thoroughness with which he had covered the subject. He desired to bring up a few points for discussion, not in a critical manner, but in the hope of securing further information.

An engineer accustomed to dealing with rivers in the east would be impressed by the extraordinarily large precipitation and run-off encountered in the Alouette and Stave lake drainage areas, and by the fact that the maximum flood discharge occurred in the month of October. He would ask whether this discharge of 15,000 cubic feet per second from the Alouette river had been measured above or below Alouette lake. It had been found that over a period of six years of flow records on the Nipigon river, although the maximum rate of mean monthly outflow from lake Nipigon was 9,800 cubic feet per second, the maximum rate of inflow into the lake was 23,700 cubic feet per second. He presumed that the large safety factor for which the Alouette spillway had been designed, having a ratio of 30,000 to 15,000, was selected to take care of such a condition, or possibly it was felt that with an earth dam considerably more spillway capacity should be provided than if a concrete dam could have been built.

With reference to the earth dam, this type of structure would appear to be very well adapted to the foundation conditions existing in this region. The author had stated that the material available for the embankment was all clay and carried a very large proportion of fines. In comparing the mechanical analysis of the material used with those of several dams built by the Miami Conservancy District, he had found that they compare very favourably, showing that the material used contained a large proportion of sand rather than being composed of clay alone.

From examination of the cross-section of the dam, he would judge that the structure would be amply stable. The upstream and downstream slopes were generous, and it was wise to make them so on account of the difficulty of predicting accurately the action of wet clay in a structure of this type.

He had noticed the absence of cut-off trenches under the core, excepting two very shallow ones for the purpose of bonding the fill to the existing bottom. The author had stated that the area occupied by the dam was cleared of all timber and other growth, and in addition that portion underlying the clay core was stripped of all vegetable matter and top soil, until the clay strata was exposed. Examining the cross-section, it would seem that in this case the clay strata lay very close to the surface.

If the top soil existed to a depth of twenty feet over the strata of clay, would the author have considered it necessary to excavate down to the clay for the full core width, or would he have excavated a narrow trench only, in order to obtain what he considered a proper seal? Mr. Hogg would be much interested in hearing his opinion on this point.

With regard to the construction of the dam, ordinary standard practice had apparently been followed throughout, except that two sets of monitors were used for depositing the fill in place. It had been stated that the employment of monitors for spreading, instead of the usual method of dumping from trestles, had a two-fold advantage. Firstly, it was more economical, and, secondly, the thorough working over with water of all the material going into the dam eliminated practically all settlement during and after completion of the structure.

The second stated advantage was, to his mind, open to argument. He would expect that a dam built by the semi-hydraulic fill method would have enough seepage from the central pool to saturate the material sufficiently at the outside slopes. The side material should be of such quality as to allow proper drainage for the core, and if the material at these points was not pervious the core would not consolidate, and the structure would be unstable.

Under certain conditions, namely, when the major portion of the available material for fill was pure clay with a large percentage of fines, a certain portion of these fines were of a colloidal nature which, when combined with too much water, formed a jelly-like substance which would not consolidate. This colloidal material was stable, however, when combined with a limited amount of water, such as might be absorbed by percolation. It was impossible to eliminate all fines, even at the toes, and he believed that where such material existed it should be placed from trestles or by the dry method, as in the ordinary type of semi-hydraulic fill dam, thereby eliminating the amount of water in the toe material; otherwise the stability of the structure might be jeopardized.

Another point to which he would refer was the method of carrying the tracks on the dam structure during construction. The author had stated that the fill was dumped at or near the outer slopes, but did not make it clear whether the tracks were carried over the dam on trestles or laid directly on the fill. Further information on this point would be instructive.

It was evident from a study of the foundations that any spillway structure at this site must be rather expensive. In selecting the particular type of concrete spillway used, he presumed that the author had investigated a layout involving submerged pipe or conduits under the earth dam with tower control and discarded it as being more expensive or not feasible under the circumstances. The method of unwatering through a tunnel which kept the water entirely away from the dam site, if possible, is always the better way.

It appeared from the drawings that the underside of the piers of the 20.5-foot Stoney gate section was flush with the bottom of the 9-inch slab. He assumed that the piers and the slab were separated by expansion joints, so as not to induce serious fractures at this point. The author stated that the 9-inch slab was poured in 20- by 30-foot blocks separated by ¼-inch sheets of asphalt and asbestos fibre compound, and that the mesh reinforcement was carried through these expansion joints. Would he have considered it good practice to leave out the asphalt and asbestos fibre compound and depend on the reinforcement to distribute the temperature and shrinkage stresses?

The hydraulic jump which will form at the lower end of the ogee section would no doubt dissipate the energy of the water to a considerable extent, and it would be interesting to know its location and extent for various flows, as the danger of undermining the foundations was apt to be very serious, in spite of all the protective measures which could be taken, such as the placing of a heavy mattress of boulders well tied together at the lower end of the concrete work.

In regard to the tunnel, the economics of the lined and unlined section were no doubt given considerable study, as this section formed such a considerable part of the cost of the development. He noticed that the screens protecting the tunnel mouth were separated from the gate structure by about 65 feet, and that apparently no means had been provided for cleaning the screens or replacing them in case of a breakage without the use of a diver, or else by lowering the lake. Practice in the east is usually to combine the gates and screens in one structure and make provision for unwatering with stop-log grooves in front of both screens and gates.

He considered the concrete surge chamber quite ingenious and a very permanent structure. He would expect that the usual type of differential surge tank would cost about the same, but would provide better regulation. However, as Alouette was an automatic station tied in with the Stave Falls plant, possibly it would be operated primarily as a base load plant, in which case regulation would not be a deciding factor.

A gate had been provided at the outlet of the surge chamber and also a valve in the power house arranged for remote control. Could either or both the gate and the valve be closed from Stave Falls in case of an emergency?

He noted that the penstock is in two sections: the enclosed portion 13 feet in diameter being a reinforced concrete pressure conduit, while the lower section 12 feet in diameter was of steel plate supported on saddles and not concreted in. He would appreciate knowing the reasons leading to the use of these two different sections.

In the power house, a valve of the balanced cylindrical type was used at the entrance to the scroll case. As this was a comparatively new type in his experience, any data with reference to its cost and reliability in comparison with the usual type of penstock valves would be very instructive.

The scroll case was, of course, designed to withstand the full water pressure, but was not completely covered with concrete, due to the elevation of the turbine operating floor, and he would expect that this might tend to cause vibration. The weight of the generator appeared to be supported on a structural steel framework consisting of two heavy girders and two 36-inch cross beams framing into them. In two recent plants constructed by the Hydro-Electric Commission of Ontario on the Trent river this type of construction had been used, but the beams and girders were completely concreted in with the generator floor slab. The method of supporting the generator framework and the rotating parts on this structural steel framework was evidently considerably cheaper than the type of solid construction on the Trent, but he would expect that the resulting vibration might be serious with only a thin floor slab as at Alouette.

At Stave Falls the high rate of run-off, approximately 8.6 cubic feet per second per square mile, was of interest, and the huge storage reservoir created by raising Stave lake an additional 22 feet enabled the use of 90 per cent of the total flow. In mentioning the limited turbine capacity of the old units under the higher head, possibly this condition could be improved by the installation of new runners designed for the higher head.

It was evident from the drawings that the shingle bolt chute has a decided curvature in plan. He presumed this had been designed with the outer edge elevated above the inner one, and would like to ask for further information on the operation of this chute.

In the Blind Slough dam four Tainter gates have been installed. He said that they were a little afraid of this type of gate in the east on account of operation in the extreme cold weather, but possibly in the British Columbia climate they operate quite satisfactorily.

In connection with the fifth unit at Stave Falls, he would enquire the reasons for installing it on the west side away from the main dam, rather than to the east of the existing units. The location chosen necessitated crossing all the other penstocks with the new one, and was responsible for the exposed overhead inlet to the spiral scroll cases. Also, this fifth penstock tapers uniformly from 20 feet diameter at the intake to 13 feet at the valve. Would it not have been more economical construction to use the same diameter throughout or else two sections of varying diameters?

In selecting the flow for installation at the proposed Ruskin development, a load factor of 4,200 divided by 9,100, or 46.2 per cent, had been used, while at Stave Falls a load factor of 4,200 divided by 7,100, or 59.1 per cent, was found. This low load factor at Ruskin, he presumed, was intended to bring the mean system load factor down to 49.5 per cent, according to the tabulation near the end of the paper. Would it not have been advisable to apply the lower load factor at Stave Falls plant, where a much larger head pond is available and consequently a small fluctuation in headwater level would be found? With regard to load factors, observation had shown that as far as Ontario is concerned, there had been a gradual raising of the load factors on nearly all the systems. Whereas some years ago 50 per cent load factors had been quite common, now it was not unusual to find 70 per cent, and even higher. This higher load factor meant a cheaper production of energy for any given plant, as a smaller installation was required to develop power from a given regulated flow.

The proposed layout at Ruskin appeared to be a very economical one, and a concrete dam, founded on good solid rock, gave a distinct feeling of security. On first looking at the general plan, the question arose in his mind whether it would have been cheaper to locate the headworks structure in line with the main dam. This would have lengthened the penstocks, but saved a considerable amount of headrace excavation.

The secondary screens had 1½ inch clear openings, while it was the Commission's practice in units of this size, using over 2,000 cubic feet per second, to space the rack bars at least 3 inches apart, on account of the large water passages in the turbine, thereby reducing the loss through the racks.

He was heartily in agreement with the idea of using large units and fewer of them in any plant to reduce the operating and maintenance charges. Of course, in a separate plant, not connected with other stations, if less than three or four units were installed, the average overall operating efficiency in the translation of water to power would be noticeably lower.

Mr. E. E. Carpenter, M.E.I.C.

The author in reply observed that some of the points brought out during the discussion would have been of great value had they been available during the planning period of the project; perhaps, with the advance of professional methods, it might some time develop that engineers would take the time and assume the courage to put before their fellows plans of proposed work before its execution was undertaken, thereby making possible a realization of the advantages of such discussions.

In the following remarks, he would attempt to cover most of the points raised by the members participating in the discussion, and to clear away certain indicated obscurities.

As regards run-off, Messrs. Brace, D'Aeth, Hogg and Brown had all commented upon the large yield of the watershed, the yield of over 8 cubic feet per second per square mile being extraordinary in comparison with eastern watersheds. The answer to this comment lay in the extraordinarily heavy rainfall prevailing on the watersheds in question. The Coquitlam watershed, lying to the north and east of the Alouette and Stave watersheds, and supplying the company's Buntzen plants, had a similarly heavy yield. The station at which the precipitation was measured over the watershed lay some 150 feet higher than the Alouette station and several miles further inland. The observed precipitation covering a period of about twenty-two years varied from a minimum of 116 inches to a maximum of 170 inches annually. The average yield per square mile of the Coquitlam watershed was about 8.1 cubic feet per second. In this connection, it might be interesting to note that the increase in precipitation seemed to vary as much with the distance inland of the station as with its altitude.

Answering the inquiry of Messrs. Brace and D'Aeth as to the seal between the earth fill and the concrete abutment, he would state that in building the south abutment to the spillway structure a concrete core wall about 30 inches wide was extended from the south side of the abutment for about 12 feet into the core of the dam. Carefully selected clay was puddled and tamped by hand around the core wall and against the abutment to insure an efficient seal with the core material.

The thickness of the spillway lining had been given very careful consideration. Climatic conditions at the site were not severe, the season of frost being very short and temperatures seldom extending below 8° to 10° F. The clay material in which the banks were excavated was firm and stable, and the slopes provided were generous. It was felt that the situation was well taken care of with the reinforcement and the expansion joints provided. The structure had at this date been subjected to two seasons of use, and observations showed that no cracks have developed in the concrete either in the floor or in the sides of the spillway. The expansion joints had functioned normally. It was needless to say that the matter of construction cost was carefully considered in adopting the thickness of lining.

The somewhat extraordinary location of the fifth unit and its penstock at the Stave Falls plant was explained by the fact that this plant, as originally planned, provided for only four units, and as a consequence no facility existed in the intake dam for a fifth pipe line. Under the circumstances, the only logical place to take the fifth penstock out was in one of the bays of the old sluice dam. Owing to the topographical limitations and the arrangement of the power station itself, it was necessary to place the fifth unit at the west end of the present station; hence the necessity of crossing the four existing pipe lines with the fifth unit penstock.

The question of spillway capacity at Alouette raised by Mr. Hogg was a very important one. The record flood of 15,000 cubic feet per second in 1921 was measured in outflow at the lower end of Alouette lake. Based upon this figure, estimates were made of corresponding inflow, although no measurement of inflow was actually made. The inflow corresponding to this flood was calculated to have been about 22,400 cubic feet per second. After a thorough consideration of the pondage effect of the lake at its raised elevation, and a consideration of the most extreme conditions of precipitation and their probability of occurrence, the capacity of 30,000 second feet for the spillway was decided upon. It was true that the type of the dam had a considerable weight in dictating the generous spillway capacity adopted.

With reference to the puddle material or fines occurring in the clay from which the Alouette dam was built, it should be noted that all the clays prevailing in the territory under consideration were of glacial origin and practically all contained a certain amount of silt or very finely graded sands, sometimes called locally *rock flour*. Under the conditions at Alouette, this occurrence of *rock flour* was beneficial to the puddle material.

The cut-off trenches under the core of the dam were excavated wholly in the existing clay formation. The amount of stripping was comparatively small, being the heaviest in the bed of the stream, where the current had deposited local lenses of sand which reached a depth of 10 to 12 feet in spots.

With reference to the materials forming the outside slopes of the dam, and its ability to drain the core material, it was admittedly difficult to describe the actual condition which existed. As a matter of fact, the clay material used, when delivered at the dam, was largely in the form of small chunks or blocks, which in themselves had a comparatively high resistance to the erosive action of the nozzle streams. Thus, the breaking up of these blocks or chunks by the action of the dump monitors was quite limited, and the fines then released were largely carried into the pool by the force of the streams, and a limited proportion only left in the slope fill itself. As a consequence, the slopes, while being thoroughly washed and saturated, retained their ability to drain the central pool to a satisfactory degree, and no trouble was actually experienced in this direction.

The railway tracks, from which the material was dumped, were carried near the outer slopes of the dam, and in approximately 5-foot raises or lifts. The raising of these tracks was accomplished by dumping gravel from centre-dump cars, and progressively lifting the track, intact, with jacks. At the end of the lift the track occupied a position on the outer slope of the dam. The process was somewhat expensive, but not as expensive, it was believed, as it would have been to construct a series of trestles to accomplish the same purpose, particularly in view of the flat slopes employed.

The idea of taking care of the flood spill by means of submerged pipe was discarded on account of the large quantity of water to be handled and the difficulties imposed by the heavy amount of drift carried in the lake at all times.

With reference to the question of the possible omission of the expansion joints in the spillway lining, it was not considered that the light reinforcement provided could be relied upon to distribute the temperature stresses sufficiently to insure against cracking of the body of the slabs. The slab between the piers separating the Stoney gates was designed with heavy reinforcement to act as a beam to distribute the load imposed from the piers, and this reinforcement was amply capable of taking care of the temperature stresses in that section.

With reference to the lack of provision for cleaning the intake screens, the author's experience in British Columbia had indicated that submerged screens of this character, and with the wide spacing of 6 inches, were seldom or never troubled with clogging. Any clogging that might occur would be in the form of a heavy submerged log which would require some special means of removal other than the raising of the screens.

It was not intended to arrange the caterpillar gate at the head of the penstock for automatic control from Stave Falls; it would, however, be arranged for remote control from the power station itself. It was considered that the automatic control of the balanced valve immediately back of the turbine casing would answer all the purposes required. The reason for the use of the concrete-lined pressure conduit for the upper portion of the penstock was wholly an economic one. With the limited reinforcing which stressed the steel to its elastic limit under extreme conditions, the concrete-lined section was the more economical. This was therefore employed to a point where the weight of the rock cover equalled the hydrostatic head imposed upon the conduit. The remaining portion of the penstock was constructed of steel pipe, this proving to be more economical than a fully reinforced concrete conduit.

The balanced cylindrical valve used at the entrance to the scroll casing was a comparatively new type in this country, and had recently been developed by the English Electric Company, who had furnished it. It resembled in its action the well known Johnson valve, but had, it was believed, some additional and valuable features, particularly with respect to differential rate of closing, and the consequent avoidance of the danger of water hammer. It was, in addition, well adapted to automatic operation, and was employed as the basic means of automatically shutting down the plant in case of trouble.

With reference to the danger of vibration in the power house building, due to the fact that the scroll casing was not fully encased in concrete, he considered that this would be obviated by the other construction features. It would be noted that the floor slab was 12 inches in thickness, and that the beams and girders were encased in concrete, while the entire floor system was tied in on three sides to the solid rock of the foundation pit.

In designing the outlet for the spillway of the Alouette dam, the ogee structure had been adopted only after full consideration had been given to other types and other means of taking care of the situation. The stilling pool method recommended by Mr. A. F. Meyer, consulting engineer, of Minneapolis, was investigated, but was discarded on account of the conditions inherent in the site. In order to use this method, it would have been necessary to construct the overflow portion of the spillway in such a manner as to give the water a comparatively free overfall into the stilling pool. Since this drop of about 38 inches occurred in an unstable bank of clay intermingled with sand strata in its upper parts and consisting almost entirely of sand in its lower portion, it would obviously have been necessary to construct a gravity section barrier to accomplish the purpose. This barrier or retaining wall would have been a veritable dam in sections capable of retaining the earth behind it. The expense involved would have been very great, both for excavating for the installation of the barrier and the provision of the barrier itself. In the type of structure adopted, this condition had been avoided. The ogee section was built on a slope which insures the stability of the bank behind it without any retaining effect upon the concrete. In the author's opinion, the stilling pool method was, under certain conditions, a most desirable one, but was adapted more particularly to locations where the free fall could be obtained without any great added expense.

Although the spillway had been in operation for two years, no occasion had arisen for carrying any great quantity of flood through it. About 5,000 cubic feet per second had been the largest amount of water carried so far.

Examination of the mattress and apron at the lower end of the ogee structure indicated that no damaging action was taking place so far.

Mr. Brown was quite correct in his assumption that the generous dimensions given the log chute were necessary on account of the large sized timber growing on the watershed which might have to be handled through the log chute from time to time. Logs as large as six or seven feet in diameter and 40 feet in length were provided for. The necessary water for splashing the logs down the river below the dam would be supplied by the Stoney gates, and it was estimated that from 5,000 to 6,000 cubic feet per second would be required. As yet no necessity had arisen for passing any timber products through the dam.

In connection with the question of tail-water level raised by Mr. Brown, the matter of the draught or suction head permissible had been very carefully looked into in the early stages of the design. The problem was discussed with all the major manufacturing companies, both in Canada and Great Britain, and suggestions were obtained from them, taking due account of the pitting effect. The suction head of 13 feet, shown in the design, was within the limits of any of the recommendations received. It would be interesting to observe the result under operating conditions.

With possible variations of both lake levels of over 40 feet, the problem of operating heads became a complicated one. It was obviously desirable to set the tail-water level at the Alouette plant as low as practicable, thereby making it possible to utilize the lower range of levels as useful heads. After an elaborate study, which covered the imposing of draught conditions on the mass curves of both streams for a ten-year period, the tail-water level of 316 was finally determined. The studies had indicated that only during fourteen months of the ten-year period would the Stave lake level drop below 316.

Mr. Gaherty's comment on the flood conditions of Stave lake are most interesting. It would no doubt be enlightening to him to know that during the flood of October 1921, which passed over the old spillway works as constructed by the Western Power Company of Canada, it was estimated that between 80,000 and 90,000 cubic feet per second were discharged through the spillway and over the crest of the dam. The water at that time reached an elevation which threw it a few inches over the crests of the intake dam and the old sluice dam. Fortunately, no damage resulted, but the experience was useful in planning the reconstructed spillway.

THE

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Institute Headquarters Building Number Changed

The number of The Institute Headquarters building in Montreal has been changed from 176 to 2050 in accordance with the general renumbering of buildings on many of the streets in the city. Accordingly, while the location of The Institute Headquarters is not changed, the address in future will be:—

THE ENGINEERING INSTITUTE OF CANADA,
2050 Mansfield Street,
Montreal, Que.

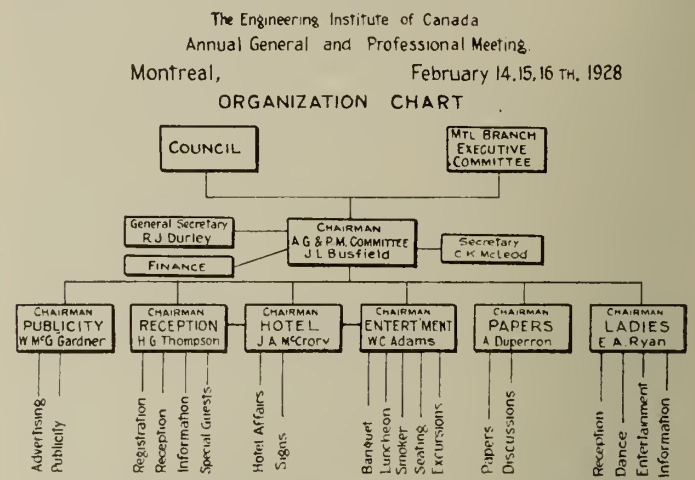
Arrangements Being Made for Annual General Professional Meeting

As announced in the June issue of the Journal, the Montreal Branch, under whose auspices the Annual General Professional Meeting for 1928 will be held, is actively engaged in the preliminary arrangements for the meeting.

Judging from the work already done, the committee in charge of arrangements will leave nothing undone in their efforts to make the 1928 meeting surpass any previous similar gathering of The Institute.

At a meeting of the Main Committee, on June 21st, the chairman announced the details of the various sub-committees, the organization being shown on the accompanying diagram. The chairman of each of the six sub-committees shown on this chart will form, with the general chairman and the secretaries of The Institute and the Branch, the Main Committee, which will determine the broad policies of the programme and will submit the arrangements for the approval of Council and the Executive of the Montreal Branch.

At the meeting of the committee referred to above, progress was reported by the various sub-committees, and it was announced that a general outline of the programme of technical sessions had been drafted and that papers of outstanding merit on various phases of engineering were being prepared. As the details of the programme become available they will be announced in the columns of the Journal.



Students Offered Fellowship Prize

The Royal Bank of Canada has announced that it will award a fellowship of the amount of $1,000 or a cash prize of $250 to a graduate or undergraduate student at a Canadian university who writes the best paper, not exceeding 3,000 words in length, on any one of certain specified subjects during the academic year of 1927-28. The student winning the prize may select either the $1,000 fellowship at any university in Canada or $250 in cash.

The papers must be submitted to the economist's department of The Royal Bank of Canada before March 1st, 1928; they should be typewritten and numbered. The name of the student should be submitted in a sealed envelope with the paper.

Preference will be given to papers which are non-technical in terminology and most practical in their treatment.

The winning paper becomes the property of the bank, and, at the option of the bank, may be published as the bank sees fit. A non-winning paper remains the property of the student submitting it.

The subjects for the 1927-28 fellowship will be as follows:—

Does Canada need a Federal Farm Loan System?
A study of the Tory report and federal legislation.

Canada's optimum of population and how it may be obtained.
In this context the word optimum may be defined to mean the ideal number of people of the type which will be most satisfactory for the building of the nation.

The potential development of Canadian trade in one of Canada's foreign markets.

Economic possibilities of the Maritimes.
A study of the Duncan report.

The papers will be judged by the economist's department of the bank, and five of the best papers will be submitted for final judgment to a committee of prominent men not connected with The Royal Bank of Canada.

The Origin and Development of the Canadian Society of Civil Engineers, now The Engineering Institute of Canada

The sixtieth anniversary of Confederation and the fortieth anniversary of the incorporation of the Canadian Society of Civil Engineers occur this summer, and this has suggested the inclusion in this month's number of some account of the early days of the Society which later became The Engineering Institute of Canada.

Conditions have changed greatly in forty years, and many of the members who took part in the discussions and negotiations which led to the formation of the Society are no longer with us. It therefore seems well to put on record, while the information is available, a brief account of the inception and early development of the Canadian Society of Civil Engineers.

Engineering work in Canada dates back to the seventeenth and early eighteenth centuries, when the activities of the French military engineers were naturally directed principally to the construction of the fortifications necessary to defend their infant cities against the incursions of the Indians and the British colonists from the south. Although much of their handiwork is in ruins, yet enough remains at such places as Quebec and Louisburg to attest the ability and skill of these pioneers.

In the course of time, the French were succeeded by the British military engineers, who not only erected fortifications, but also built roads and commenced the construction of canals and other public works.

The first road was opened from Quebec to Montreal in 1734, being gradually completed with the growth of the French settlements, and the St. Lawrence canal system was commenced in 1779. A highway from York to Simcoe was constructed in 1794. The canal system was under active development during the beginning of the nineteenth century, the present Lachine canal, (along the line of a smaller channel constructed by the French), having been commenced in 1821, and the Welland canal in 1824, while the Rideau canal was completed in 1832.

Many of these works were designed originally for military purposes, but were essential to the development of communications in Upper Canada, which at this period was only accessible by canoe or bateau, or by following Indian trails. The early settlers had been practically cut off from communication with the rest of the world, and had to subsist largely on their own resources. With the development of transportation facilities came the civil engineer.

Railway construction commenced in Canada about 1830, the first line, that from Laprairie to St. Johns, Que., having been opened in 1836, but railway development was not at its height until the 'fifties, at which period there was a considerable influx of civil engineers into Canada, many of whom were brought out from Britain, while others came from the United States.

After the Union of Upper and Lower Canada, there arose an insistent demand for efficient and rapid means of communication between the two provinces, and for access to the Atlantic during the winter when navigation is closed on the St. Lawrence. The result of this movement was the construction of the railway from Montreal to Toronto in 1856, so that by 1860, on the completion of the Victoria bridge at Montreal, there were eight hundred miles of direct railway communication from Portland to Sarnia.

In 1867, the Confederation agreement called for the construction of the Intercolonial Railway to connect the Upper and Lower provinces, and this and other projects led to increased activity on the part of engineers.

From this time on, small groups of engineers were to be found scattered throughout the Dominion, and the first movement towards the organization of an engineering society appears to have been set on foot by Mr., (afterwards Sir), Sandford Fleming, chief engineer of the Intercolonial Railway, who, with some other prominent men, endeavoured to interest members of the profession in the advantages of such an association. Difficulties at that time, however, proved insuperable, and it was not until after the entry of British Columbia into the Confederation had led to the undertaking and construction of the Canadian Pacific Railway, and considerable engineering development had taken place in the west, that conditions ripened sufficiently to enable a society to be organized with success. In May 1880, Mr. E. W. Plunkett had circularized engineers in Canada, setting forth the necessity and advantages of organization, and, possibly as a result of the circular, an attempt at the legal regulation of civil engineers in Ontario was made in February 1881, when " an act respecting civil engineers " was introduced in the Legislative Assembly of the province of Ontario. In this bill, the following gentlemen were designated "Civil Engineers in Grade A":—Walter Shanly, T. C. Keefer, Sandford Fleming, J. L. P. O'Hanly, John Page, Thomas Guerin, Marcus Smith, G. Trudeau, Samuel Keefer, Frank Shanly, Kivas Tully, Charles Baillarge, Peter Grant, Charles E. Legge and " all other persons who shall obtain a diploma or commission in the manner hereinafter provided for." Mr. O'Hanly is credited with having made this attempt to form a society, but the bill did not commend itself to the Legislature, or, indeed, to all of the fourteen engineers named in it, and it never reached the committee stage.

About this time, the authorities of Toronto and McGill Universities, especially the latter, realized the importance of having educational facilities for training engineers, and the advantage of having an association with which to cooperate, if such could be formed.

Montreal, Toronto and Ottawa were the cities most frequented by the profession, and conditions suitable for the formation of a society were gradually developing at these places.

The idea of a Canadian engineering society was apparently present during this period in the minds of many members of the profession, and during the construction period of the Canadian Pacific Railway the scheme was very thoroughly canvassed by such men as Alan MacDougall, C. E. W. Dodwell, T. C. Keefer, Sandford Fleming, J. L. P. O'Hanly, S. Keefer, Frank Shanly, Kivas Tully and others, both in Ontario and Quebec. In February 1886, Alan MacDougall of Toronto issued a circular over his own signature advocating the formation of an association, and as a result numerous meetings were held in Toronto, Ottawa and Montreal, of which perhaps the most important was that of the fourth of March, held in Montreal at the Harbour Commissioners' office, of which the manuscript minutes have been preserved. Alan MacDougall was in the chair, and P. W. St. George acted as secretary. At this meeting it was moved by H. D. Lumsden, seconded by P. A. Peterson, and resolved that:—

> "A society of engineers in Canada be formed comprising all branches of engineers, and that a committee be appointed to meet the other committees of engineers from other cities, and then to arrange and form a preliminary constitution, which form of constitution shall be sent around to those gentlemen who send in their names as being willing to form such a society; and that each gentleman present be requested to forward the names of engineers and their addresses to the local secretary."

The Montreal local committee was then appointed, consisting of Messrs. Hannaford, Kennedy, St. George, Blackwell, Lumsden, Wallis, Bovey, Peterson and Dodwell. Later, meetings of this committee were held at McGill College and at Mr. Kennedy's house, resulting in the draught of a constitution for the proposed society.

On the 30th of March, 1886, as the result of conversations between Mr. R. A. Davy and Lieut.-Colonel W. P. Anderson, a meeting took place in the City Hall, Ottawa, and was addressed by Alan MacDougall. The Montreal draught constitution was considered and afterwards amended by the Ottawa local committee. This meeting was attended by T. C. Keefer, Collingwood Schreiber, Thomas Ridout, F. J. Lynch, Alan MacDougall, W. P. Anderson, H. F. Perley, Robert Surtees, L. J. R. Steckel, E. E. Perrault, H. A. F. MacLeod, W. McCarthy, E. V. Johnson, F. N. Gisborne, G. A. Mountain, G. R. L. Fellowes, R. A. Davy, and about twelve others.

A similar local committee had been acting in Toronto, and had appointed delegates to confer with those from Ottawa and Montreal.

The Montreal local committee held another meeting on November 11th, 1886, and considered a printed constitution which in the interval had been prepared and amended by correspondence between the local committees at Montreal, Toronto and Ottawa. Messrs. Kennedy, St. George and Bovey were elected as delegates to meet those from the Ottawa and Toronto local committees, and a provisional committee was formed, first to revise and complete the constitution and second to establish the association. This provisional committee consisted of:—Colonel C. S. Gzowski, Kivas Tully, W. T. Jennings, A. MacDougall, T. C. Keefer, H. F. Perley, W. P. Anderson, R. Surtees, H. T. Bovey, J. Kennedy, P. A. Peterson and P. W. St. George. Mr. MacDougall was appointed provisional secretary.

On December 9th, 1886, the provisional committee held a meeting at the St. Lawrence Hall, at which it was decided to call the proposed society the "Canadian Society of Civil Engineers," and the provisional secretary was authorized to issue a circular soliciting applications for membership, and to enclose with it a copy of the printed constitution that had been prepared by the provisional committee. The circular was accordingly issued on December 21st, 1886. This constitution, of which a copy is preserved in the first manuscript minute-book of the Canadian Society of Civil Engineers, was printed in Ottawa in 1886, but bears no other date.

At the meeting on December 9th, it was further resolved that the provisional committee should hold a meeting on the second Tuesday in January for the election of members and to decide on a date for a general meeting of the Society.

On January 19th, 1887, the provisional committee met accordingly at the St. Lawrence Hall, Montreal, to consider a list of applicants for membership, and on the following day met again in the board room of the Harbour Commissioners' office, those present being Messrs. Keefer, Kennedy, Bovey, St. George and Peterson. One hundred and sixty-two elections to membership were effected, namely:—

104 Members.
25 Associate Members.
8 Associates.
25 Students.

Again, on the 21st of January and the 3rd of February, 1887, further meetings of the provisional committee were held, and, on the latter date, the membership was further augmented. Elections were made in this way up to February 24th, on which date 288 members of all classes had been elected by the provisional committee, namely:—

168 Members.
39 Associate Members.
12 Associates.
69 Students.

The first officers were elected by letter ballot, which was sent to members who joined previous to February 24th, and was canvassed at the first general meeting. This was held at 3.00 p.m. on Thursday, February 24th, 1887, in the board room of the Harbour Commissioners' building, Montreal, at which the result of the ballot was announced and the reports and actions of the provisional committee were adopted and approved.

The minutes of this gathering can be found in the first annual report of the transactions of the Canadian Society of Civil Engineers, together with a list of those present. Representatives came from Toronto, Ottawa and other places, and it was decided to apply to the Dominion Government for a charter. As a result of the letter ballot, the following were declared elected as officers of the Society:— T. C. Keefer, president; Sir C. S. Gzowski, John Kennedy and Walter Shanly, vice-presidents; fifteen councillors, and H. T. Bovey, secretary and treasurer.

The charter was carried through Parliament by one of the vice-presidents, Walter Shanly, M.P., and received Royal sanction on June 23rd, 1887. It incorporated the Society, defined its objects and powers, and enabled it to pass regulations and by-laws for the direction and management of its affairs.

As a result of the formal incorporation of the Society, however, all previous proceedings were annulled, for preliminary decisions and elections are not legalized by such an act of Parliament. It therefore became necessary to hold a new election and to adopt the constitution afresh, which was done by a second vote of the members.

Accommodation for the Society's meetings was provided during the early years of its existence by the kindness of McGill University, but as the Society developed and funds became available it was found possible to lease convenient rooms, and in 1890 the secretary's office and the library were moved to the upper floor of the Bank of Montreal building on the corner of Mansfield and St. Catherine streets. The need for extension was soon felt and met in 1899, when the house at 877 Dorchester street was purchased and adapted for the uses of the Society. There Headquarters remained until 1913, when the present building at 2050 Mansfield street was purchased so that adequate facilities for the office staff, library and meeting rooms could be provided.

From the very beginning, the young Society showed healthy growth, as is shown by the fact that its original membership of about three hundred doubled itself in the first ten years of its existence; in thirty years the membership reached the three thousand mark, and shortly afterwards the change of name took place, accompanied by far reaching modifications in constitution and activities. On April 15th, 1918, the Canadian Society of Civil Engineers became The Engineering Institute of Canada, the alteration of name being authorized by an act of the Dominion Parliament.

The vigorous and steady development of The Institute through forty years of strenuous life to its present membership of five thousand is a matter of history, and he would indeed be a timid and half-hearted prophet who would set bounds to its future status, influence and usefulness.

Note:—This account is based on a paper by Mr. R. A. Davy, M.E.I.C., on "The Inception of the Canadian Society of Civil Engineers," together with data taken from Mr. T. C. Keefer's Presidential address in 1888, information furnished by Mr. C. E. W. Dodwell, HON. M.E.I.C., Mr. H. A. Lumsden, Past President, E.I.C., and the minutes of various meetings and committees, so far as these have been preserved.

Meeting of Council

Meeting of June 21st, 1927

A meeting of Council was held at eight p.m. on Friday, June 21st, 1927, President A. R. Decary, M.E.I.C., in the chair, nine other members of Council being present.

The Secretary reported that on June 1st the Plummer Medal was presented to Professor T. Thorvaldson, of Saskatoon, Sask., on the occasion of his visit to Montreal, at which time a small luncheon was given in his honour. It will be recalled that the Plummer Medal for 1926 was awarded jointly to Professor Thorvaldson and Professor C. J. Mackenzie, M.E.I.C., for their paper on "Differentiation of the Action of Acids, Alkali Waters and Frost on Normal Portland Cement Concrete."

The financial statement to May 31st, 1927, was submitted and approved.

As announced in the report of the meeting of Council held on April 22nd, in the May number of the Journal, the agenda for the proposed Plenary Meeting of Council which is to be held in Montreal in October was prepared, and this report was submitted to Council and approved.

In connection with the Plenary Meeting of Council, on the suggestion of Councillor H. R. MacKenzie, A.M.E.I.C., it was decided that the meeting should be held during the second week in October instead of the third week, as previously arranged, so that Councillors wishing to attend the Centenary Celebrations at the University of Toronto may do so on their way to attend the meeting in Montreal.

The final draft of the proposed rules for the award of the new Institute prizes was submitted by Councillor J. L. Busfield, M.E.I.C., for approval, and the Secretary was directed to forward copies of this to all members of Council for their consideration so that the matter may be brought up again at the September meeting of Council for consideration.

The report of the meeting of the Board of Examiners and Education held on May 26th, 1927, containing the results of the examinations held on May 3rd, 1927, was presented and approved.

The appointment of Mr. J. L. Stiver as a member of the Canadian National Committee of the International Electrotechnical Commission was approved.

The personnel of the Leonard Medal Committee for the current year was submitted and approved.

The personnel of the Papers Committee was submitted and noted, it being decided to add to the Committee the names of the secretaries of those branches which have not sent in the names of their representatives for this year.

The recommendations of the Finance Committee with regard to three reinstatements and four special cases were considered and approved.

Three resignations were accepted.

The following elections and transfers were effected:—

Elections	
Member	1
Associate Members	4
Juniors	3
Students	7

Transfers	
Associate Member to Member	2
Junior to Associate Member	1
Student to Junior	2

Fourteen applications for admission and transfer were scrutinized and classified for the ballot returnable July 18th, 1927.

Four special cases were considered in connection with applications for admission.

The Council rose at ten-thirty p.m.

OBITUARIES

Capt. George Arthur Bennet

Deep regret is expressed at the news of the death of Captain George Arthur Bennet, which occurred at Ste. Anne de Bellevue, Que., just after his return from Kamloops, B.C., where he had spent the winter in quest of health. His ill health was the result of his having been gassed during his service overseas when he was connected with the 3rd Battalion of Engineers.

The late Captain Bennet was born at New Glasgow, Que., on December 5th, 1888, and graduated from McGill University with the degree of B.Sc. in 1911, and in the course of his comparatively short professional career, interrupted by war service, he was engaged with the John S. Metcalf Company, Limited, and undertook elevator work in the ports of Montreal, Fort William and Chicago.

Captain Bennet joined The Institute as Student on December 8th, 1908, and transferred to Junior on March 16th, 1915, but on account of ill health he resigned on October 27th, 1925.

William Evlyn Roe, A.M.E.I.C.

It is with deep regret that we record the death of William Evlyn Roe, A.M.E.I.C., which occurred on January 1st, 1927, as the result of a fall while at his work two days before at Jasper, Alta., between which town and Edson he had been roadmaster for the Canadian National Railways for the past three years.

The late Mr. Roe was born at Newmarket, Ontario, on October 7th, 1882, and received his early education at the high school at Newmarket.

In 1906 he joined the Grand Trunk Pacific Railway as chainman, rodman and instrumentman on location and construction and in 1912 was appointed resident engineer on construction. From 1915-19 he was overseas with the Royal Air Force and Royal Flying Corps as flying officer. After the war he returned to the Grand Trunk Pacific Railway as instrumentman on maintenance of way, and was located at Edmonton, Alta.

The late Mr. Roe joined The Institute as an Associate Member on March 23rd, 1920.

A Re-Verification of the Dominion Standard Yard*

The Dominion Standard Yard is defined in the Weights and Measures Act, 1873, 1906, etc., as being determined by a specified bar now in the custody of the Department of Trade and Commerce, Ottawa.

This standard yard is made of bronze and is one inch square in section and 38 inches in length. At two points, one inch from either end, holes are drilled to the neutral surface (i.e. one-half inch deep). A gold plug, one-tenth of an inch in diameter, is inserted in the bar at the bottom of each hole for the purpose of bearing the defining lines. On each plug there are two parallel lines one one-hundredth of an inch apart ruled in an axial direction with a single line ruled across them in a transverse direction. The Dominion standard yard is stated by the law† to be the interval between the two transverse lines, measured at the points midway between the two longitudinal lines when the bar is at a temperature of 61.91° F.

The standard yard is marked "'Mr. Baily's metal,' 'Standard Yard' 'A,' 'Troughton and Simms, London.'" It is carefully preserved in an iron safe, see figure No. 1, together with a standard metre, a standard pound, a standard troy ounce and a standard kilogramme.

The Dominion standard yard was received from England in 1873, with two similar standards, known as the "parliamentary copies." These were deposited respectively with the speakers of the House of Commons and of the Senate, and were for the purpose of periodically checking the standard and also of allowing it to be replaced in the event of its destruction. All three bars were studied by the deputy warden of the standards in England before shipment to Canada and the temperature of 61.91° F. of which the Dominion standard is exactly one yard in length, is derived from tests made with duplicates of the imperial standard yard in 1873.

It is many years since the Dominion standard yard was verified, and hence it is of scientific as well as legal interest to know how its present length agrees with that determined in the original standardization. This is particularly the case in all survey work and other technical operations, as it is always assumed that the Canadian yard has the same length as the imperial yard.

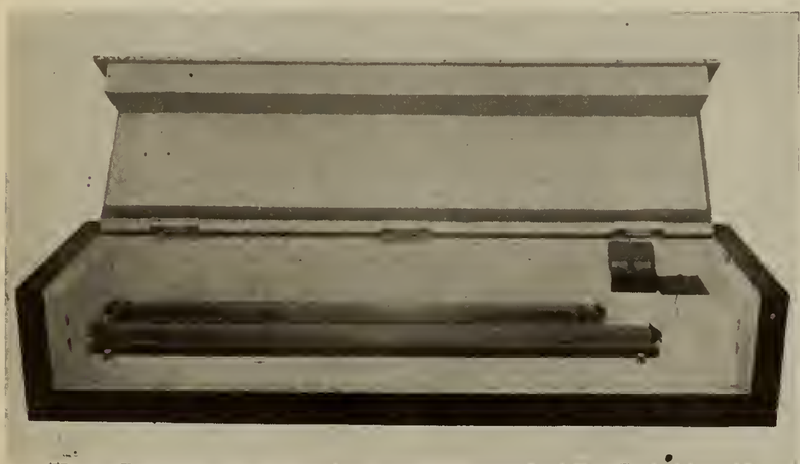


Figure No. 1. (Left).— The Dominion Standards.

The interior of the safe in which are preserved the Dominion standards of length and mass. The Dominion standard yard is the shorter of the two rules. Near the ends of the rule are clearly seen the holes, at the bottom of which are engraved the lines defining the yard interval. The longer rule is the old Dominion standard metre, and in the pockets at the end of the safe are kept the standard pound, the standard troy ounce and the standard kilogramme.

Figure No. 2. (Right).— The Rules Employed at the Physical Testing Laboratory in the Recent Re-Verification of the Dominion Standard Yard.

The Dominion standard yard is in the foreground. Next in order are: (1) a nickel rule, (2) a 42 per cent steel rule, and (3) a 36 per cent nickel steel (Invar) rule. Rules (1) and (2) have been verified in England with copies of the Imperial yard, and at the International Bureau of Weights and Measures, Sevres, France,. with a copy of the international metre.

Since 1873 there have, naturally, been considerable developments in meteorological science, but the standard yard of that date continues to be the fundamental length unit of the British system. In all cases where the unit is defined by the length of a material bar there is an uncertainty due to possible secular changes in the material itself. As far as the British standards are concerned there is no evidence that the yard and its copies have changed by a measurable amount in recent years, although it is possible that changes have occurred at earlier periods in the life of the yard. As the imperial standard yard was more than twenty years old when the Dominion standard and its copies were originally verified it is probable that any change found in the relative lengths of the two

* This description was prepared by F. H. Peters, M.E.I.C., director, Topographical Survey, Department of the Interior.

† The Weights and Measures Act, chapter 52, R.S., c. 104, s. 1.

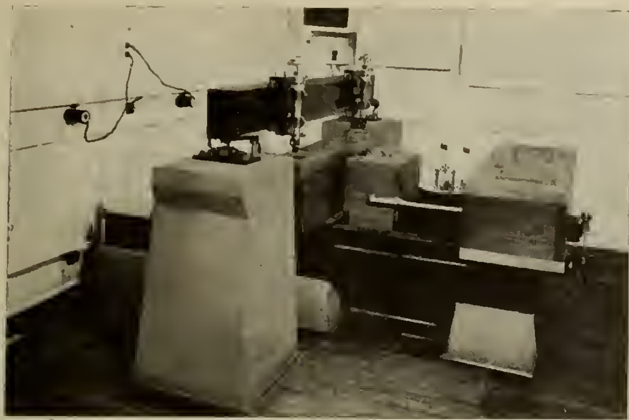


Figure No. 3.—Length Comparator, Physical Testing Laboratory.

This comparator was used in the re-verification of the Dominion standard yard. It is constructed to permit the comparison of the lengths of two rules when both are at the same temperature, or with one rule at one temperature and the other at a different temperature. It is also employed for absolute determinations of the co-efficients of thermal expansion.

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standards would be due to alterations that have taken place in the Dominion standard, which was quite new when standardized, hence the desirability of a re-verification.

The usual method for determining the length of a precision line standard is to compare it in turn with three, or preferably more, rules which in the course of the same operation are also compared one with another. Furthermore, each rule of the pair is compared with the others in every possible position relative to one another and to the observer.

A test of this nature to check the length of the Dominion standard yard has just been completed at the Physical Testing Laboratory, Topographical Survey, Department of the Interior, Ottawa. Four rules were employed, including the Dominion standard and two laboratory rules with one yard intervals, which had been carefully verified at the National Physical Laboratory, England, against copies of the imperial yard; these copies having themselves been verified directly with the imperial yard a short time previously. The four rules are illustrated in figure No. 2.

The recent comparison of the Dominion standard was carried out in the length comparator of the laboratory, with the rules immersed in distilled water to ensure that their temperatures were identical and also the same as was indicated by thermometers placed adjacent to them.

Essentially the comparator, figure No. 3, consists of a tank containing the rule supports with adjustments for bringing the rules to the focus of two micrometer microscopes carried on a water-filled cast iron girder supported over the tank. During a comparison the tank is traversed backward and forward beneath the girder and micrometer readings are taken on the rules in turn. The whole apparatus is supported on massive concrete piers and every precaution is taken to eliminate known sources of error.

Three observers participated in the test, working independently of each other. This latter feature is of some importance in the case of the Dominion standard, the defining lines of which are much poorer in quality than those of the more modern standards with which it was compared. Even when the finest engraved lines are viewed under a microscope magnifying one hundred diameters, irregularities become very pronounced, and the micrometer readings of different observers may vary slightly.

The thermometers employed in the test were standardized against the standards of the Physical Testing Laboratory. Temperature measurement is of extreme importance in this test. The bronze of which the Dominion standard yard is composed expands nearly eighteen parts in one million for a temperature rise of one degree centigrade. In order to keep thermal errors from becoming excessive it is therefore necessary to measure the temperature of the water bath to one one-hundredth of a degree.

At the time of writing the results of the test are not fully computed, but it is proposed to publish them as well as a complete account of the work, here only briefly sketched, in pamphlet form.

PERSONALS

J. L. Busfield, M.E.I.C., of Montreal, is sailing on the "Empress of Australia" on July 5th, to spend three months in England and European countries in connection with business matters.

Jack S. Robinson, S.E.I.C., who graduated from Queen's University with the degree of B.Sc. this year, has accepted a position with the Bailey Meter Company, Limited, Cleveland, Ohio.

H. M. Black, S.E.I.C., who since 1923 has been in the steam turbine department of Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has joined the general sales staff of the English Electric Company of Canada, Limited, Toronto, Ont.

J. S. Connell, M.E.I.C., who for some years past has been residing in Vancouver and was for a time manager of the Foundation Company of British Columbia, is now located at Phoenix, Arizona, with the Salt River Valley Water Users' Association.

C. U. Vessot, A.M.E.I.C., for the past seven years lecturer in mechanical engineering at McGill University, has been appointed works engineer of J. S. Fry and Sons (Canada) Limited, Montreal. Mr. Vessot is a native of Holyoke, Mass., and received the degrees of B.Sc. in 1920 and M.Sc. in 1922 from McGill University.

J. H. Ings, Jr.E.I.C., has joined the staff of the Spruce Falls Power and Paper Company, Kapuskasing, Ont. Mr. Ings is a graduate of the University of Toronto of the year 1925, and has for the past year been resident engineer on the construction of Section 7 of the Kapuskasing-Smoky Falls Railway with Messrs. Morrow and Beatty, Limited.

E. E. Lord, A.M.E.I.C., who has been located at Newchwang, North China, for the past seven years, is returning to Canada, having resigned his position as assistant engineer of the Lower Lioa River Conservancy owing to the extremely unsettled conditions now prevailing in China. Mr. Lord's home is in Vancouver, where he will reside upon his return to Canada.

George H. Pringle, S.E.I.C., who, since graduating with honours from McGill University in 1926, has been with the Canada Paper Company, Windsor Mills, Que., has accepted a position with the Mead Pulp and Paper Company, Chillicothe, Ohio, and is engaged on plant engineering, maintenance, extensions and improvements. The three summers prior to graduation Mr. Pringle spent in Three Rivers, Que. The summers of 1923 and 1924 with the Canada Iron Foundries and the summer of 1925 with the Canadian International Paper Company on construction work.

C. E. Potter, J ., Jr.E.I.C., has resigned from the Toronto Transportation Commission to accept a position with Mr. Roy H. Bishop, architect, Oshawa, Ont. Following graduation from the University of Toronto with the degree of B.A.Sc. in 1925, Mr. Potter was with the Geodetic Surveys of Canada as instrumentman and engineering clerk. In June 1926 he joined the Wayagamack Pulp and Paper Company, Three Rivers, as transitman. During the summer months of his university course he was employed on mine surveying, railway maintenance and general land surveying.

R. J. Fuller, A.M.E.I.C., formerly with the John V. Gray Construction Company, Limited, is now located at Oshawa, Ont., with Mr. Roy H. Bishop, architect. Mr. Fuller graduated from the University of Toronto with the degree of B.A.Sc. in 1912. During the summer months of his university course he was engaged with a contractor in Mimico, Ont., the Dominion Bridge Company and with the Canada Foundry Company. In November 1912 he entered the department of the city architect and superintendent of buildings, city of Toronto, where he remained until 1917, when he was appointed chief engineer of the John V. Gray Construction Company, Limited.

G. H. Kohl, M.E.I.C., has entered private practice as consulting engineer at Sault Ste. Marie, Ont., where he has been located for the past nine years. Mr. Kohl graduated from McGill University with the degree of B.Sc. in 1910, and during 1911-12 was with the test department of the Canadian Westinghouse Company at Hamilton, Ont. Later in 1912 he was engaged on field work for the Prince Rupert Hydro-Electric Company on surveys and preliminary design. In 1915 he went overseas and was on active service until the end of the war, receiving his commission in the Royal Engineers in May 1919. Following demobilization, he joined the staff of the Spanish River Pulp and Paper Mills at Sault Ste. Marie in 1919 as structural engineer, and has been with this company since that date.

L. C. Dupuis, A.M.E.I.C., division engineer, operating department, Canadian National Railways, Levis, has been temporarily transferred to division engineer, construction department, in charge of the St. Felicien-Mistassini extension. Mr. Dupuis was born at St. Roch des Aulnaies, county of L'Islet, Que., on November 8th, 1896, and received his education at Laval Normal School and Laval University Survey School and by private tuition. His early work was in connection with land and timber surveys, and in 1911 he became assistant engineer with the Intercolonial Railway at Moncton, N.B., continuing the following year in the same position at Levis, Que. He has remained at Levis practically ever since, occupying successively the positions of resident engineer with the Intercolonial Railway, engineer on double tracking, assistant engineer with the Canadian Government Railways and division engineer of the Saguenay division, Canadian National Railways, and later, in 1924, division engineer of the Levis division.

John L. Guest, A.M.E.I.C., Returns to Richmond, Va.

John L. Guest, A.M.E.I.C., has resigned as office engineer of the Aluminum Company of Canada, Limited, Arvida, Que., and has returned to Richmond, Virginia.

Mr. Guest is a native of Birmingham, Alabama, where he was born on August 13th, 1898, and received the degree of B.Sc. from the Virginia Military Institute in 1918, and the degree of C.E. from Cornell University in 1921.

From June to December of 1918, Mr. Guest was training in the U.S. Army as 2nd lieutenant, Field Artillery, and the following year was draughtsman, instrumentman and inspector with the Virginia State Highway Commission. From 1921-23 he was with the Southern Power Company, Charlotte, N.C., working on the design of two hydro-electric plants, two steam plants and also preliminary work in connection with the Isle Maligne power development. The next two years he was in charge of all plans for the construction of the plant of the Quebec Development Company, Limited, at Isle Maligne. From October 1925 until the time of his resignation he was with the Aluminum Company of Canada as office engineer in charge of draughting room, preparing plans for the aluminum plant at Arvida and miscellaneous work for Roberval and Saguenay Railway.

Major J. K. Wyman, A.M.E.I.C., has taken over the duties of superintendent of the government elevator at Port Colborne, Ont. Major Wyman is a graduate of McGill University, having received the degree of B.Sc. in civil engineering in 1910, and for the following five years was engaged on heavy building construction with the John S. Metcalf Company, the Bathurst Lumber Company and the Foundation Company of Canada. He served overseas with distinction, being commissioned a 2nd lieutenant in January 1916 while in England, following which he left for Egypt and later in the year was ordered to Salonika. He was gazetted Captain in June 1917 and Major in July of the following year and was O.C. of a field company of Royal Engineers. In 1918 he was mentioned in despatches. At the end of the war he returned to England for demobilization in April 1918, subsequently serving as Major in the military engineering service in India until March 1924. Following this, Major Wyman returned to Canada, and has been connected with the Department of Railways and Canals since that date.

M. J. Rutledge, A.M.E.I.C., Appointed City Manager of St. Lambert, Que.

M. J. Rutledge, A.M.E.I.C., recently appointed city manager of St. Lambert, Que., assumed the duties of his new office early in June. Mr. Rutledge resigned as town manager of Woodstock, N.B., where he was succeeded by E. Blake Allan, A.M.E.I.C., as announced in last month's Journal.

Mr. Rutledge was born at Brighton, Mass., in 1887, and is a graduate of the University of New Brunswick, from which he received the degree of B.Sc. in 1908. Following graduation, he was engaged in service in connection with the Hudson Bay Railway, and for two years, commencing 1910, he was on similar work with the Canadian Pacific Railway. In 1912 he joined the staff of the Dominion Bridge Company, remaining with this company until the end of 1913, when he was engaged on subway design with the Public Service Commission of New York for three years. Returning to Montreal in 1916, he was designer in connection with the Mount Royal tunnel. Subsequently, in 1918, he became second assistant to Henry Holgate, M.E.I.C., consulting engineer, Montreal, and remained with Mr. Holgate until his appointment as town manager of Woodstock, N.B., in the early part of 1923.

Recent Graduates in Engineering

In addition to the list of Juniors and Students of The Institute who have recently completed their course at the various universities, as published in the June issue of the Journal, congratulations are also in order to the following, results of which examinations were received too late for publishing with the main list last month:—

Nova Scotia Technical College

Atwood, Arthur Gerald Michael Ignatius Lysons, B.Sc., (Me.), Halifax, N.S.
Hayman, Alden Bernard, B.Sc., (El.), Truro, N.S.
Hillis, James Stanley, B.Sc., (Me.), Halifax, N.S.
Hutton, John Robert, B.Sc., (El.), Halifax, N.S.

University of New Brunswick

Barbour, Ronald Granville, M.Sc., (El.), Fredericton, N.B.
Steeves, Cecil Myron, B.Sc., (El.), Peterborough, Ont.
Woods, Francis Cedric, B.Sc., (Ci.), Fredericton, N.B.

Officers of the Associations of Professional Engineers

The Association of Professional Engineers of the Province of New Brunswick

The following are officers of the association for the year 1927:—

President ....J. D. McBeath, M.E.I.C., Moncton, N.B
Past President ....A. Gray, M.E.I.C., St. John, N.B.
Vice-President ....G. Stead, M.E.I.C., St. John, N.B.
Secretary and Registrar..J. A. W. Waring, A.M.E.I.C., asst. engr., C.P.R., St. John, N.B.

Councillors:—

St. John District ....J. P. Mooney, A.M.E.I.C., St. John, N.B.
S. R. Weston, M.E.I.C., St. John, N.B.
Moncton District ......G. C. Torrens, A.M.E.I.C., Moncton, N.B.
F. Williams, A.M.E.I.C., Moncton, N.B.
Chatham District ......W. R. Campbell, Campbellton, N.B.
Fredericton District ....J. Stephens, M.E.I.C., Fredericton, N.B.

Registration of Members

The total membership, 163.

The Association of Professional Engineers of the Province of Nova Scotia

The following are officers of the association for the year 1927:—

President ....C. H. Wright, M.E.I.C., Halifax, N.S.
Vice-President ....G. S. Stairs, A.M.E.I.C., Windsor, N.S.
Secretary-Treasurer ....W. P. Morrison, M.E.I.C., P.O. Box 225, Halifax, N.S.

Councillors:—

K. L. Dawson, A.M.E.I.C., Halifax, N.S.
C. A. D. Fowler, M.E.I.C., Halifax, N.S.
G. W. H. Perley, A.M.E.I.C., New Glasgow, N.S.
J. S. Misener, M.E.I.C., Halifax, N.S.

Registration of Members

Civil, 139; mechanical, 34; mining, 20; electrical, 20; and chemical, 1; total, 214.

The Corporation of Professional Engineers of the Province of Quebec

The following are officers of the corporation for the year 1927:—

President ....A. R. Decary, D.A.SC., M.E.I.C., Quebec, Que.
Vice-President ....C. N. Monsarrat, M.E.I.C., Montreal, Que.
Hon. Secretary-Treasurer.Frederick B. Brown, M.E.I.C., Montreal, Que.
Registrar ....A. Mailhiot, Esq., 294 St. Catherine St. E., Montreal, Que.

Councillors:—

O. O. Lefebvre, M.E.I.C., Montreal, Que.
A. B. Normandin, A.M.E.I.C., Quebec, Que.
Alex. Fraser, A.M.E.I.C., Quebec, Que.
Hector Cimon, A.M.E.I.C., Quebec, Que.

The Association of Professional Engineers of the Province of Ontario

The following are officers of the association for the year 1927:—

President ....A. B. Cooper, M.E.I.C., Toronto, Ont.
Vice-President ....A. D. LePan, A.M.E.I.C., Toronto, Ont.
Past President ....H. J. Lamb, M.E.I.C., Toronto, Ont.
Secretary-Treasurer and Registrar ....R. B. Wolsey, 96 King St. W., Toronto, Ont.

Councillors:—

George T. Clark, A.M.E.I.C., (Ci.), Toronto, Ont.
H. B. R. Craig, M.E.I.C., (Ci.), London, Ont.
*A. H. Harkness, M.E.I.C., (Ci.), Toronto, Ont.
R. L. Dobbin, M.E.I.C., (Me.), Peterborough, Ont.
*Col. Ibbotson Leonard, M.E.I.C., (Me.), London, Ont.
M. B. Watson, A.M.E.I.C., (Me.), Toronto, Ont.
H. M. Lancaster, (Chem.), Ottawa, Ont.
*J. W. Rawlins, (Chem.), Copper Cliff, Ont.
L. Joslyn Rogers, (Chem.), Toronto, Ont.
*A. B. Lambe, A.M.E.I.C., (El.), Ottawa, Ont.
H. W. Price, (El.), Toronto, Ont.
C. E. Schwenger, (El.), Toronto, Ont.
E. A. Collins, (Mi.), Copper Cliff, Ont.
D. L. H. Forbes, (Mi.), Kirkland Lake, Ont.
*George R. Mickle, (Mi.), Toronto, Ont.

* Appointed by the Lieut.-Governor in Council.

The Association of Professional Engineers of the Province of Alberta

The following are officers of the association for the year 1927:—

President ....W. J. Cunningham, A.M.E.I.C., Edmonton, Alta.
Vice-President ....R. S. L. Wilson, M.E.I.C., Edmonton, Alta.
Past President ....B. L. Thorne, M.E.I.C., Calgary, Alta.
Secretary-Treasurer and Registrar ....R. J. Gibb, M.E.I.C., City Engr's. Dept., Edmonton, Alta.
Representative on the Senate of the University of Alberta ....A. L. Ford, M.E.I.C., Banff, Alta.

Councillors:—

H. W. Meech, A.M.E.I.C., (Ci.), Lethbridge, Alta.
H. P. Keith, A.M.E.I.C., (Ci.), Edmonton, Alta.
R. B. Baxter, (El.), Edmonton, Alta.
G. H. Thomson, (El.), Calgary, Alta.
J. A. Carruthers, A.M.E.I.C., (Me.), Lethbridge, Alta.
Vernon Pearson, A.M.E.I.C., (Me.), Edmonton, Alta.
M. J. Hilton, (Mi.), Edmonton, Alta.
G. Kellock, (Mi.), Coleman, Alta.

The Association of Professional Engineers of the Province of British Columbia

The following are officers of the association for the year 1927:—

President ....F. Sawford, Vancouver, B.C.
Vice-President ....J. F. Frew, M.E.I.C., Vancouver, B.C.
Secretary-Treasurer and Registrar ....E. A. Wheatley, A.M.E.I.C., 930 Birks Building, Vancouver, B.C.

Councillors:—

C. Brakenridge, M.E.I.C., Vancouver, B.C.
P. P. Brown, M.E.I.C., Vancouver, B.C.
C. P. Browning, Britannia Beach, B.C.
J. J. Fingland, Trail, B.C.
J. D. Galloway, Victoria, B.C.
L. Killam, Vancouver, B.C.
E. G. Matheson, Vancouver, B.C.
E. E. Walker, Vancouver, B.C.
G. A. Walkem, M.E.I.C., Vancouver, B.C.

Concrete Water Conduits

Two curious cases of the rapid deterioration of concrete water conduits were recently reported in the Paris journal, L'Eau. A contractor was entrusted in 1913 by the municipality of Vannes, Brittany, with the work of laying a conduit for potable water to that town. He proposed a pipe line of cast-iron, but the municipality decided in favour of one of concrete. This conduit was completed in 1915, but after a time the amount of water delivered by it began to fall off, and, finally, became so small that it was decided to uncover and make an inspection of the work. It was then found that every length was perforated all over; the joints alone were found to be practically intact. An action at law followed, and the finding was against the contractor, who was said to have carried out the order unsatisfactorily. The contractor, however, on appeal, won his case, since experts appointed to go into the matter decided that the destruction of the conduit was due to the fact that the water conveyed by it was of a very pure nature, and as it contained a very small amount of mineral substances in solution, it tended to decalcify the cement. They added that a leaner mixture of concrete would have shown greater resistance to deterioration. Another concrete conduit in the same district, which had been in the hands of another contractor, was also found to be in the same bad condition. In this instance the contractor also won his case, his defence having been that the manufacturers from whom he had obtained his concrete pipes were a firm approved by the municipality; the pipes, moreover, were duly inspected and passed at the works by an engineer of the municipality, and all had satisfactorily undergone the required tests. The first contractor further contended that the responsibile party was really the author of the scheme, a municipal engineer, who ought to have known the nature of the potable water to be conveyed and to have specified the quality of cement best suited to it. A further conclusion arrived at was that if the laying of cast-iron pipes, as proposed by the first contractor, had been agreed to, no untoward circumstance would have arisen. Our Paris contemporary remarks that no data can be found in textbooks concerning such decomposition of cement by pure water, as appears to have occurred in these two instances. We understand that both concrete pipes are now being replaced by others of cast-iron.—(From *Engineering*, May 20th, 1927.)

ELECTIONS AND TRANSFERS

At the meeting of Council held on June 21st, the following elections and transfers were effected:—

Member

BURWASH, Lachlin Taylor, M.E., (Univ. of Toronto), exploratory engr. N. W. Territories and Yukon Br. Dept. of Int., Ottawa, Ont.

Associate Members

BOSSU, Francois, C.E., (Univ. of Mtl.), civil engr. with city of Montreal, Montreal, Que.

McDONNOUGH, Ralph Baylis, B.A.Sc., (McGill Univ.), ch. engr. Quebec Power Company, Quebec, Que.

NICOLLS, Jasper Henry Hume, B.Sc., (McGill Univ.), research chemist and supervisor of routine lab., Fuel Testing Labs., Dept. of Mines, Ottawa, Ont.

ALDEN, Langford Taylor, C.E., (Rensselaer Poly. Inst.), private practice as consulting engr., Vancouver, B.C.

Juniors

BACKTEAROW, Evan, B.E., (Prague Univ.), P. Lyall and Sons Constrn. Co. Ltd., on concrete constrn., Union Station, Toronto, Ont.

KINGSMILL, Charles Grange, B.A.Sc., (Univer. of Toronto), Aluminum Co. of Canada, Arvida, Que.

MOLKE, Eric Charles, occasional Student, Univ. of Toronto, Toronto, Ont.

Transferred from class of Associate Member to that of Member

BLAIR, David Edward, B.Sc., (McGill Univ.), general supt. Montreal Tramways Co., Montreal, Que.

MONKMAN, George Humphrey Nelson, asst. engr., C.P.R. engrg. dept., Winnipeg, Man.

Transferred from class of Junior to that of Associate Member

DESMARAIS, Raymond Joseph, asst. city engr., Windsor, Ont.

Transferred from class of Student to that of Junior

BEAVERS, George Robert, Can. Blower & Forge Co., Kitchener, Ont.

McCUAIG, Donald Alexander, B.Sc., (Univ. of Man.), i/c western office of Ferranti Electric Limited, Winnipeg, Man.

BOOK REVIEW

Handbook of Engineering Mathematics

By Walter E. Wynne and William Sparagen, Van Nostrand Company, New York, 2nd edition. Leather, 6¾ x 4 in., 282 pages, $2.50.

The contents of this handbook cover the wide range of algebra; geometry; trigonometry, plane and spherical; calculus; theoretical mechanics; mechanics of materials; hydraulics; electricity; aeronautics, and a variety of tables, including physical and chemical constants. The title does not give a true idea of what one may reasonably expect to find in the volume.

The portion of the text devoted to mathematical formulae is concisely put together and the various operations are well and clearly illustrated for one who has a knowledge of the use of mathematical operations. For the individual who has little or no idea of mathematical usage the formulae are useless. The remainder of the book gives many of the usual formulae in constant use in engineering practice.

The aeronautics section constitutes a departure that is novel and indicates one of the modern trends. The information given is extremely interesting to the layman and is, no doubt, as accurate and as up-to-date as that found in the other departments.

The book should be a useful addition to the library of the engineering university student, especially where the use of handbooks and notes is allowed in examinations. To the practising engineer, one hesitates to say that the book will fill a great need. Most of the information is always found in the specialized handbooks of the subject concerned. As to the mathematical part of the book, the average engineer is generally so rusty on the subject that mere formulae do not give him sufficient information as to how to proceed, with the possible exception, perhaps, of geometrical and trigonometrical operations.

T. R. Loudon, M.E.I.C.

Publications of Other Engineering Societies

As previously announced in the Journal, an exchange arrangement exists between The Engineering Institute of Canada and the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers and the American Society of Mechanical Engineers.

Subscriptions may be sent either directly to New York or through Headquarters. The following list of rates gives in the first column the amounts payable by members of The Engineering Institute for the various publications:—

	Rate to Members	Rate to Non-Members
American Institute of Electrical Engineers		
Journal, single copies	$0.50	$ 1.00
" per year	5.50	10.50
Transactions, per year, paper	5.00	10.00
" " " cloth	5.00	10.00
Year Book	1.00	2.00
Pamphlets	.25	.50
American Institute of Mining and Metallurgical Engineers		
Magazine, single copies	0.50	1.00
" per year	5.00	10.00
Transactions, per volume, with pamphlets, paper	2.50	5.00
(Other publications, same rate E.I.C. members as to A.I.M.M.E. members.)		
American Society of Civil Engineers		
Proceedings, single copies	0.50	1.00
" per year	4.00	8.00*
Transactions, " "	6.00	12.00†
Year Book	1.00	2.00
(Other publications 50 per cent reduction on catalogue price to E.I.C. members.)		
**If subscription is received before January 1st, otherwise $10.00.*		
†If received before February 1st, otherwise 1st, otherwise price $10.00.		
American Society of Mechanical Engineers		
Journal, single copies	0.50	0.60
" per year	4.00	5.00
Transactions, per year	6.00	8.00
Year Book	1.00	2.00
(Other publications, same rate to E.I.C. members as to A.S.M.E. members.)		

Report of Manitoba-Ontario Boundary

An interesting report has been issued by the commissioners appointed to direct the survey of the meridian-line boundary between the provinces of Manitoba and Ontario. When these two provinces were extended in 1912 the boundary between them was defined, but at that time only a small portion of this boundary had been run upon the ground, namely, that part of the meridian-line boundary lying south of Winnipeg river. In 1921 and 1922 the meridian-line boundary was surveyed under the direction of the two commissioners, the Director of Surveys, Toronto, for the province of Ontario, and the Surveyor-General, Ottawa, for the Dominion of Canada, to a point at which it turns northeasterly. The report just issued presents an historical sketch with the incidents leading up to the necessity for the survey, the present boundaries, methods of survey, actual surveys made, and a general description of the district. The report is well illustrated and is accompanied by an atlas of maps embodied in sixteen sheets. Copies of the report and atlas may be obtained from the Topographical Survey, Department of the Interior, Ottawa, at a nominal fee.

ABSTRACTS OF PAPERS READ BEFORE BRANCHES

The Engineering Profession and Its Relation to Engineering Education

E. A. Wheatley, A.M.E.I.C.
Registrar, Association of Professional Engineers of British Columbia.

Vancouver Branch, April 6th, 1927.

The provincial and state engineering authorities should be consulted in drawing up the curricula for engineering students.

"What would help to clarify the reasonable scope of a college programme more than some broad understanding on this matter between the colleges, the engineering societies, and engineering industries?"(1)

All the other professions through their legal bodies, (registering bodies), exercise some influence, if not control, over the education of their students. Why not the engineering professions, as represented by its licensing and examining authorities?

"If other forms of professional education have suffered from too rigid a standardization at the hands of related professional bodies, engineering education may have suffered because its professional and industrial sponsors have been too aloof."(1)

The licensing authorities are the logical bodies to co-operate with the educational authorities, as finally the licensing authority has to declare as to the university student engineer's fitness to practice engineering. The need for the influence of the licensing authority is evident.

"It is the aim of the faculty of applied science to give a broad education useful in almost any life of affairs. . . . Not one-half of the present students (in the faculty of applied science) will ever enter the engineering profession."(2)

"I repeat, gentlemen, not half of the science students will enter the field of engineering, so the university does not wish to give the faculty of applied science a professional school label. It wishes to encourage all who can be induced to take this training."(2)

Lawyers are eminently successful in life. What would the member of the profession of law say if university authorities encouraged "all who could be induced" to take a so-called law course headed in the university calendar: "A course in law leading to a degree in law," on the grounds that it would fit them for any life of affairs, having first eliminated the bulk of its professional studies, done away with the entrance requirements such as degree of arts, and rejected any control by the Law Society?

"Intermediate technical schools play practically no part in our educational system. The junior college is not a substitute, consequently, the universities are carrying the heavy burden of extra high school instruction."(3)

These routinists, technicians, and mechanics, have the same professional label as the men who propose to become practising engineers.

"The engineering curricula to-day is . . . a distinctive type of college programme based primarily on the principles and applications of physical science and mathematics, with associated studies in languages and social sciences, and intended to precede and supplement, but not supplant an extended professional apprenticeship."(4)

Should not the examining and licensing authorities have something to say on a curriculum which is summed up in this way, and which, nevertheless, is headed in calendars "a course in civil, or mining engineering leading to a professional degree"?

"The engineering college is not the exclusive instrumentality of engineering education. In a satisfactory scheme it would share the field with schools giving a more intensive form of technical training, and would be supplemented by means for extending professional training beyond college. The present unbalanced situation is a cause of inefficiency and confusion."(5)

Even if all the universities giving an engineering education agreed, as the above quotations indicate, that the curricula were designed to furnish a broad and general education "to precede and supplement but not to supplant an extended professional apprenticeship," even then the licensing authorities should be consulted and certain safeguards taken, namely, that the courses should be designated in all calendars that they were courses of a broad and general nature; that they were courses in the principles and applications of physical science and mathematics, with associated studies of languages and social science, and they would lead to a corresponding academic degree, not a professional degree, such as B.Sc. in C.E. or B.C.E. Further, that the calendars should carry clear information that such a course did not authorize graduates to term themselves or deem themselves engineers, but that an extended professional apprenticeship should be undertaken under the control and according to the advice of the licensing authorities of the state or province.

Unfortunately, not only is no reference made to the licensing authorities, but the university authorities are by no means uniform in their attitude on this subject. Some of the university authorities, while giving a merely supplementary and general form of education, claim it as a professional engineering education.

"Our present-day engineering courses are professional in character. The various branches of engineering are professions,—not merely branches of a profession. Civil engineering is a distinct profession,—distinct from mechanical engineering or electrical engineering. This distinction is universally recognized. We clearly accept it in our designation of the curricula in our engineering colleges. In most cases employers requesting young graduates specify the courses in which they have been prepared. Why should we continue to burden our professional engineering students with the academic brand of general science, as if the civil engineering portion of the scientific course still consisted of a few hours of surveying with a little mechanics and hydraulics?"(6)

"Insofar as it is possible, a degree should convey a definite meaning to those who are familiar with college education. The meaning of the degree of B.S., as now used, is not evident. At least it does not conform to its original conception, which was that it marked the completion of a course in general scientific subjects."(6)

"The degree B.C.E. does represent the completion of a course of study in a certain professional line, namely, civil engineering."(6)

"Certainly it is much to be preferred in this respect to C.E., which is still given by a few institutions after the completion of a four-year course. The degree M.C.E., (Master of Civil Engineering), is used as a post-graduate degree for those whose first degree is C.E. This obviously is inconsistent. . . ."(6)

Thus the confusion which exists between university authorities can be seen. The licensing authorities being the final authority to examine the university graduate, is the authority that should be referred to in drawing up the engineering curricula and designations of engineering curricula. It should not be forgotten that in many parts of the country registration as professional engineers is granted automatically on graduation, and such automatic registration is claimed as a right by university authorities.

Why should the education of a professional engineer be extended to all and sundry? To "all who can be induced to take this training"? The profession of law does not allow it; the profession of medicine does not allow it; why should the profession of engineering allow all and sundry to take this education?

It would be well perhaps if they took a really full complete professional education, but to broaden it, to make it a mere smattering of professional education, and yet to retain all professional labels, to grant professional degrees, without reference whatever to the licensing authorities, cannot be logical or right.

Professional engineers may have suffered in the past by too great specialization, and it may be necessary that professional engineers should have a degree in arts, or in a broad and general education prior to commencing their professional studies. The present general four-year course in applied science, with its supplementary subjects in social sciences, may be the preceding course required. The degree for this course, however, should not even be B.A.Sc., but should be letters indicating that it was a course in the principles and applications of physical science and mathematics, languages and social sciences, i.e., an academic degree. The engineer's professional education should come after the general education and the degree of C.E., B.Sc. in C.E., or B.C.E., should only be given on the

(1) From the preliminary report of Mr. W. E. Wickenden appearing in the September 1926 issue of "The Journal of Engineering Education." (Note:—For the engineering societies and the engineering industries substitute "the licensing authorities of the country.")

(2) Dean W. Brock, of the University of British Columbia, July 1926 issue of "The Engineering Journal."

(3) Prof. W. E. Duckering, from the November 1926 number of "The Engineering Journal."

(4) Bulletin No. 11 of the Investigating Committee of the Investigation of Engineering Education 1927, Society for the Promotion of Engineering Education.

(5) Preliminary report of Mr. W. E. Wickenden, investigator of the Society for the Promotion of Engineering Education.

(6) O. M. Leland, president of the Society for the Promotion of Engineering Education, in "A Logical Engineering Degree," January 1927 "Journal of Engineering Education."

completion of a real professional engineering course. Close contact should be made by the student of engineering with the licensing authorities, as is usual in the professions of law and medicine, chartered accountancy and pharmacy. Junior registration as pupils should be insisted on in the calenders of the universities. Adequate reference should be made to the provincial or state engineering act.

Members of the state board of examiners, and of the associations (or corporation) of professional engineers in Canada, should be members of the Society for the Promotion of Engineering Education and should be represented on all the committees.

Officers administering the engineering acts of state or province should be appointed to curricula committees of all engineering colleges. Representatives of engineering colleges should be appointed or elected to the councils or boards administering the state or provincial engineering acts.

Teaching and research work are among the highest forms of engineering, that is professional engineering. All university professors should be registered and be thus available to be members or presidents of the state or provincial licensing or registering bodies.

A professional engineering education for professional engineers should be clearly differentiated from the education for technicians, routinists, mechanics, salesmen, and business men. Professional engineering degrees should be reserved for professional engineers, and not granted to an army of industrialists with a mere smattering of engineering training, and be awarded as the reward of a real professional engineering education.

Britannia Mines

C. P. Browning.

Vancouver Branch, May 11th, 1927

Britannia mine is located thirty miles north of Vancouver on the east side of Howe sound and extends to Indian river, ten miles distant. The Union Steamship Company operates a daily boat from Vancouver up the east side of Howe sound, stopping at Britannia on both the out-going and in-coming trips. Many members of the Vancouver Branch saw the property on the trip arranged last September, and the speaker endeavoured to answer many questions asked at that time.

Britannia is not one of the old mines of the province, but was known as a deposit of some size about 1900. Since 1904 the property has been worked on varying scales of operation, of course, starting in a modest way with a few hundred tons per day, until at the present time it is an operation of 3,800 tons of crude ore per twenty-four hours. As of general interest, the speaker remarked that approximately $900,000 was paid for supplies obtained in, or through, Vancouver, and that the annual payroll totalled nearly $1,700,000 for the employees, numbering about 1,000. The buying policy of the company was: Vancouver first, Dominion of Canada second, foreign markets third.

In 1926 over 1,000,000 dry tons of crude ore were treated in the concentrating plant, which produced 33,000,000 pounds of copper besides other metals.

Mining

It would be natural as a first step in this production to go back to the mine where the mineral which we are winning is deposited. The geologists say that the source of the mineralization is in the granite, with the activities of Mount Garibaldi having something to do with the occurrence. At Britannia in a sort of fold in the granite is a large body of porphyry which is termed a roof pendant. This roof pendant extends for several miles in a general east and west direction. Part of the roof pendant became shattered or sheared, which caused fractures or shearing planes into which the primary ore bearing solutions found their way. These, on nearing the surface, with decreased pressure and cooling, deposited, making the mineralized zone in which the mining is carried on to-day. This ore zone extends for some miles in an east and west direction with a width of approximately 1,500 feet. Rock structure forms an important part in the concentrating of the mineralization, in that folds of the foot wall are very definite indices for certain mineral conditions.

The Britannia mines, so-called, are comprised of five distinct mines running from west to east. The type of deposits vary in these five sections, which means that different systems of mining must be resorted to in order to make a successful extraction of the mineralized portion.

The speaker then referred to four systems of mining, all in use at Britannia:—

(1) *Glory Hole.*
Outside method, only used when working from the top. This is the cheapest method, with good light and ventilation and immediate extraction.

(2) *Shrinkage.*
This consists of service raises, chutes and connecting through chutes, the blasting being done in the solid material by the men standing on the broken material. This method ties up broken ore which, if water runs through it, will oxidize it. It also requires good walls. The cost of this method is between 75 cents and $1.00 per ton delivered to the main haulage level.

(3) *Square Set.*
This method is used where the walls are poor and require, after mining, to be filled. The standard set in use is 10- by 10-inch timbers with 6-foot centres.

(4) *Rill Stopes.*
The inclined stope is characteristic of this type of mining. In some cases, where the walls are exceedingly bad, timbering is resorted to. The cost per ton in types (3) and (4) is about the same, averaging $3.00 per ton.

The level intervals vary, depending upon the type of mining employed. In good standing ground, 150 to 200 feet, and in poor standing ground 100 to 150 feet. The sub-level system is in use in the Victoria mine (the most easterly mine) 23 feet above the main level.

Development must keep ahead of the mining; opening up the levels, cutting chutes, and doing exploration work. Even ahead of this, the geological structure must be studied. Diamond drilling is used whenever advantageous, and even electrical prospecting. During April of a year ago a field party covered an area of 380 acres. Subsequent underground results proved quite conclusively the data they submitted, as indicated from the survey.

About 11,000 feet of diamond drilling was completed during 1926. Development in drifts, cross-cuts and raises totalled over 20,000 feet. At present there are over 50 miles of underground workings, a considerable amount of which, of course, is abandoned and unused.

About 75 per cent of the men working underground are on the bonus system, a system by which a basic rate is set, and work done over and above the basic rate is paid for in the form of a bonus.

Haulage is made over three and one-half miles of narrow gauge railway.

A large tunnel was run in at the main level (transportation level) at the rate of 14 feet per day.

Transportation

There was formerly in use two and one-half miles of aerial tramway, but increased production necessitated the building in 1917 of the inclined railway which is now in use. By this fall part of the railway at the top of this incline will be eliminated in favour of the 2,700-foot tunnel. It costs less than 10 cents per ton to haul the ore from the mine to the mill. Cars in use are of 20-ton capacity, operated by electric locomotives operating on 550-volt d.c.

Milling

The treatment of the ore in the concentrator was dealt with in detail by Mr. Browning, who took his hearers through the whole process from the storage bins to the steamer alongside the wharf, loading the concentrates.

In dealing with the milling, he stressed the point that it was impossible to compare the Britannia plant with others on account of the varying conditions, but mentioned a few cost items which might be of interest.

The total milling cost he gave as 50 cents per ton, including all direct and indirect charges. The total cost of the oils used in flotation is 3½ cents per ton.

Storage of the concentrates is provided by concrete bins of 10,000 tons capacity, the concentrates being reclaimed with clamshell and conveyed by belt to the vessel alongside the wharf.

Power

For the whole property, the needs are approximately 4,500 h.p. During wet seasons the hydro-electric development at Britannia can handle the demand, but a transmission line from the British Columbia Electric Railway Company, at 32,000 volts, supplements this source.

General Layout

A base hospital is maintained at the Mine camp, with a doctor, nurse, X-ray equipment, etc., with an auxiliary at the Beach camp, where a junior doctor is stationed. Safety first and first aid courses are given, and physical and medical examinations made.

A group insurance scheme is in force at no cost to the employees. At the completion of six months' employment, $500 insurance is in force, increasing $200 each six months to the maximum of $1,500 in three years.

The stores have been co-operative since 1922 and last year did a $500,000 business. The average number of participants is 903. They are run by the company but in conference with the employees' committee.

Means for recreation are provided, as movies, gymnasium and seasonal sports, baseball, football, tennis and boating. There are grade schools at both the Beach and the Mine camps, and community churches, both Roman Catholic and Protestant.

Mr. Browning closed with the reminder that Britannia mine employed many mining engineers; that it was not a one-man organization; that each department must be successfully and efficiently handled in co-operation with the rest of the organization.

B. C. Silver Mines

C. A. Banks.

Vancouver Branch, April 13th, 1927.

The speaker treated his subject in a general way, his remarks being of such a non-technical nature that they could be followed and enjoyed by those of his audience who were not members of the mining branch. A large wall map and blue prints were used to enable his hearers to follow clearly the gradual development of this well-known mining property. It was explained that this property lies in the Stewart mining district of the northern British Columbia coast, and with the aid of the map, a general description of the layout was given, especially in relation to Hyder (Alaska), Stewart, the international boundary, and the Premier mine. Adjoining property is held by the Selukwe and Sebakwe interests.

The Premier property, which adjoins the British Columbia Silver, was briefly described. The ore on the Premier occurs in a shear zone which strikes through the Premier and British Columbia Silver ground. The shear zone passes through both quartz-porphyry and tuff and the ore bodies occur mainly in the former rock.

In 1922 a small air compressor was put in, suitable for working two machine drills, and a 1,000-foot tunnel was commenced to crosscut the ore zone, which was reached early in 1923. The first 600 feet of the tunnel was in overburden which required heavy timbering, but after that the drift was in the solid rock and no further timbering was necessary.

A good shoot of ore was encountered when the ore zone was struck and immediately a second air compressor of 350 cubic feet capacity was installed and development was speeded up. Drifting and cross-cutting soon demonstrated that, whilst the ore was 40 feet in width where it was first struck, it did not continue laterally for more than a couple of hundred feet in the British Columbia Silver ground—development on the Premier later on showed that this same ore body extended about 300 feet into that property.

Lateral development and prospecting by diamond drilling was continued a further 800 feet along the ore zone without success and then, as the face of the tunnel was considered to be gaining depth too rapidly as it was advanced, a second tunnel was commenced 260 feet vertically above the lower tunnel. This tunnel was called No. 2, whilst the original tunnel was called No. 3.

From No. 2 tunnel the zone was prospected by diamond drilling and, at the end of two years' work, three 800-foot diamond drill holes located ore some 1,500 feet from the Premier boundary line. The lower or No. 3 level was then advanced under this area and two important ore bodies were found. These ore bodies are each about 300 feet long and vary up to 25 feet in width. The values are in gold and silver and run all the way up to $389 across a width of five feet, the bulk of the ore being of milling grade.

When these ore bodies were found, an additional air compressor of 1,050 cubic feet capacity was installed and electric storage battery underground haulage was also put in.

Whilst the property was being developed laterally, as outlined above, diamond drilling on the boundary line proved the existence of an important ore body passing into the British Columbia Silver from the Premier. This ore body is about 250 feet long and in its widest place ran $20 across 40 feet.

Work is now proceeding to find other ore bodies and to determine the tonnage of ore in the ore shoots already found. The underground work on the British Columbia Silver is now being connected with the underground work on the Sebakwe property, which adjoins the British Columbia Silver to the north and which is under the same control as the British Columbia Silver.

Some excellent photographs of the property, etc., were exhibited showing some of the ore bodies and the type of light underground locomotive in use.

Back Numbers of Journal

Requests have been received for various back numbers of The Engineering Journal of which the supply at Headquarters has been exhausted. If any member has copies of the issues mentioned below, the Secretary would appreciate receiving them at Headquarters. The issues wanted are:—March 1919, July 1920, and January and April 1921.

BRANCH NEWS

London Branch

Frank C. Ball, A.M.E.I.C., Secretary-Treasurer.

To give the members of the branch and any interested citizens an opportunity to become acquainted with the work of sewage disposal in London, a tour of inspection to two of the city's disposal plants was held in the afternoon of Saturday, April 23rd, 1927.

Members and friends met at 2:00 o'clock p.m. and motored to the Wellington and High activated sludge plant and to the East End Imhoff tank and sprinkling filter plant. W. M. Veitch, A.M.E.I.C., engineer of sewage disposal for London, conducted the party and described the operation of the two plants. At 4:30 p.m. the members gathered in the board room of the Public Utilities Commission, with Chairman J. R. Rostron, A.M.E.I.C., presiding, and a paper on " Sewage Disposal " was read by Mr. Veitch.

Sewage Disposal

The speaker outlined first the character of sewage to be treated in American cities, grouping the undesirable constituents into five classes, i.e., floating solids, fat and oily products, settleable solids, non-settleable putrescible matter and bacteria. The essential agents of sewage purification are provided and employed by nature. The slow action of the soil bacteria, aided by atmospheric oxygen, eventually converts into harmless mineral ingredients all organic matter that comes within their sphere of activities. The process is analogous to that of combustion.

The decomposition of dead organic matter may follow either of two different courses: One course is that under ordinary conditions a rapid reduction of any available oxygen first takes place, followed by an incomplete anaerobic putrefaction, i.e., a decomposition not in the presence of air, accompanied by the evolution of methane, carbon dioxide, nitrogen, hydrogen, and various evil-smelling gases such as hydrogen sulphide. The decomposition is quite different if it follows the second course and takes place in the presence of an abundant supply of oxygen. If moist organic matter is allowed to ferment in the presence of an ample supply of oxygen, a slow oxidation is accomplished by the activity of certain micro-organisms and the products are water, carbon dioxide, and nitrates. This aerobic fermentation is free from odor and its end is the complete conversion of the decomposition products into harmless inorganic constituents. Such an oxidation alone can finally dispose of the excretal products and prevent the obnoxious conditions attendant on anaerobic putrefaction.

The improvements that have been made in methods of treating sewage have not involved the discovery or application of new principles, but have merely increased the working efficiency of the natural bacterial agencies.

It is possible by sewage disposal methods to purify any sewage to any desired degree. The suspended solids may be completely removed and the organic matter completely nitrified so as to produce a clear and sparkling effluent and the bacterial purification may be carried so far as to make the effluent as pure as many water supplies. In sewage disposal there should be an economic balance which must be decided by local conditions, anything approaching complete purification is rarely necessary or economical.

Mr. Veitch described the different processes of sewage disposal from dilution to the most recent developments. This included dilution, land irrigation, grease traps, grit chambers, screens, sewage treatment tanks, sewage filters, electrolytic methods, direct oxidation, activated sludge and separate sludge digestion.

In the dilution method three points should be emphasized:

1. Eliminate all floating matter and settleable solids;
2. Sterilize the clarified sewage where, and when necessary;
3. Disperse the treated sewage in the water so that it may be properly oxidized and so that marginal pollution of the stream will be avoided.

At most places this third point is not considered at all.

The introduction of the motor car into the life of the community has made the installation of grease traps most essential, especially when activated sludge or screens form a part of the subsequent treatment.

Sewage treatment tanks were described under the headings: plain sedimentation, chemical precipitation, septic tanks and two-storey septic tanks.

Sewage filters include the following: intermittent sand filters, contact filters and trickling or sprinkling filters. These were described in some detail by Mr. Veitch.

Under activated sludge, the theory, outline of plant, process and advantages, were described. The process is, in general, as follows: Thoroughly activated sludge is added to the raw sewage in the proportion of about 20 per cent of the volume of the aeration tank. As the sewage with its added activated sludge passes through the tank it is constantly aerated by air fed through diffusers in the tank bottom. From the aerating tank the mixed sewage and sludge pass to the settling tank, in which the sludge settles rapidly, the supernatant liquor passing off through the effluent outlet. From the settling tank a portion of the sludge is drawn off to the sludge aerating tanks and further aerated to prepare it for addition to the incoming fresh sewage without additional aeration.

The digestion of the excess sludge from the activated sludge process in sludge digestion tanks is a method of disposal which has come to the front in recent years and shows strong promise of proving a most satisfactory and economical method of disposal.

At the close of the paper the meeting adjourned to the Armouries Annex, where supper was served to members and friends.

General Secretary's Visit

At a meeting on May 16th the branch had the pleasure of a visit by General Secretary R. J. Durley, M.E.I.C. Mr. Durley addressed the meeting, informing the members of activities at headquarters. He told of the plans for the October meeting of Council, at which matters of importance to the future of The Institute would be discussed. He also spoke of the uniformity of examinations for admission, the grading of members and the desirability of increased activity by the members to the benefit of The Institute.

Making Economically Durable Concrete

A very instructive paper on "Principles Involved in the Making of Economically Durable Concrete" was read by E. Viens, M.E.I.C., director of testing laboratories, Department of Public Works, Ottawa.

The proper grading of aggregate and the importance of recognizing the proper water-cement ratio and a sufficient time of mixing were described. Mixing should not be for less than one minute, and there is a rapid increase in strength up to two minutes, while five minutes gives about the maximum strength to be obtained by length of mixing. Concrete should be kept at about 70° F. for several days after mixing.

Concrete that is 100 per cent waterproof may be made by proper proportioning and curing. Concrete that tests over 3,000 pounds per square inch breaking stress will not allow water to pass. The speaker described a concrete tank in the testing laboratories that had been in use for three years and had allowed no moisture to pass through it. This tank had been very carefully tested and observed with regard to this property. For waterproofing concrete the speaker expressed a preference for the use of a little more cement rather than the use of waterproofing compounds.

Mr. Viens also discussed the use of calcium chloride in concrete. Evidence as to its corroding effect on steel is rather conflicting, although thoroughly embedded steel does not seem to be affected. Not more than two pounds per sack of cement should be used. The effect of calcium chloride on time of setting is widely different for different brands of cement. Five brands of Canadian cement all showed considerable increase in early strength due to its use.

To get a good bond between old and new concrete, the speaker recommended a dressing of neat cement, then two inches of cement mortar before the concrete is applied.

The interest in the subject of those present was manifested by the discussion after the paper and the number of questions asked. A large number of guests were present.

Mr. Viens' paper was illustrated with lantern slides.

Inspection Tour

On Thursday, May 19th, through the courtesy of the architects, John M. Moore and Company, the members of the London Branch were conducted through the New London hotel and the London Life Insurance Company's new building. This trip provided an excellent opportunity to see these buildings partly completed.

Members of the architects' staff drew attention to the points of interest and described the most modern methods and materials of construction as applied in these buildings. Members of the branch were greatly interested in such subjects as the accuracy of concrete chimney construction, the vacuum distributing system for documents, Sabonite plaster for sound-deadening and the "Underduct system" of electric and telephone wiring.

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

On June 4th a party of some twenty-eight members of the branch paid a visit to the new plant of the Riverside Iron Works. Members of the staff conducted the party through the various departments explaining the operations in detail. The stock pattern room was first visited, where a large assortment of patterns of all descriptions was noticed. From here the members were shown through the pattern-making shop, which proved to be one of the most interesting departments. Patterns for steel switch-points and street railway frogs were being fabricated and also large gear wheels requiring minute accuracy in construction. It was a surprise to learn that specially hardened steel castings could be turned out at these works.

From the pattern making department the party visited the moulding shops, where they were given an opportunity of watching the workmen making actual moulds in preparation for pouring the moulten metal. In this shop one of the chief features of interest was the electric furnace which is of the most modern type for steel smelting. It is constructed of heavy boiler plate on the outside, lined with fire brick, and containing a specially constructed crucible pot. The lower portion of the furnace is semi-circular in form, resting on rails, the tilting being done hydraulically.

With the exception of the electrical apparatus, this furnace was constructed, both inside and outside, entirely by the company. The electrical operations were very interesting and consisted of three vertical carbons of enormous diameter suspended above the furnace and entering the top jacket. These were hand controlled at present, being manipulated by hand wheels and gearing so as to maintain a constant current at the arcs. The steel is smelted at a temperature of 3,200° F. and the molten metal is poured into pots for transference to the moulds. This process was of particular interest as it was the first opportunity those in the party had had of observing the smelting and casting of steel in the west. A visit was then made to the transforming room, where the current enters on high tension wires at 12,000 volts and is stepped down to 220 volts for use in the electric furnace.

A demonstration was also made of the smelting of cast iron. Scrap iron of all descriptions was fed into the top of an iron-smelting furnace, interspersed with layers of coke in the correct proportions, the furnace being operated under forced draught. A number of moulds were poured from this furnace, the large ones from a large ladle operated by an overhead travelling crane, the smaller ones with ladles carried by hand.

The works are only partly completed and will in a short time cover a very large area of ground. Everything is up-to-date, and when completed this plant will undoubtedly prove a valuable addition to the established industries of Calgary, and indeed to the entire west.

To those who had not previously seen the plant, the visit was a revelation of the importance of the enterprise. It shows a healthy spirit of optimism on the part of the company, and emphasizes their confidence in the future of western engineering requirements.

It is a pleasure to record in these columns the thanks of this branch for the courtesy shown by the company during the tour of inspection of their works.

Word has been received that F. K. Beach, A.M.E.I.C., chairman of this branch, has secured a transfer from the Water Power and Reclamation Service, where he has been employed as an engineer for a number of years, to the petroleum office, Northwest Territories and Yukon Branch in Calgary. His new work will be largely in connection with drilling operations in Turney valley and other Alberta oil fields.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

Forest Conservation

A stirring appeal calling for the conservation and preservation of the country's forest resources, was voiced by the Hon. C. D. Richards, Minister of Lands and Mines, province of New Brunswick, in an address given before the branch, at the final supper meeting of the season, held in the Y.M.C.A. on April 26th. The Hon. Mr. Richards' remarks were part of a nation-wide campaign which is carried on each year to impress upon the people the enormous loss resulting from forest fires and to educate them to be careful.

The speaker referred at some length to the great loss resulting from forest fires and declared that last year ninety-seven per cent of these fires were due either to malice—a comparatively small cause—or to carelessness. The forests were one of our greatest assets and the basis of an industry second only to agriculture. We were today, in New Brunswick alone, producing 500 tons of pulp and 65 tons of paper daily, and looked forward to a sharp expansion in this industry. It was a serious thing, however, to realize that of the nation's timber assets, while only thirteen per cent has been cut, sixty per cent has been wasted by fire, leaving but twenty-seven per cent of the original timber standing. It was a sad but impressive thing to travel, as he had done, through the fire swept regions where great ruined trees stand, mere skeletons of their former life. Houses and other property may be destroyed and promptly replaced, but it takes eighty years to replace a forest.

The effect of fires, not only directly upon the forests but upon the rivers and streams, was emphasized by the speaker.

In conclusion, Mr. Richards referred to the fire prevention machinery and made a stirring appeal for public co-operation. "We cannot control this situation," he said, "without that co-operation"—in fact it was prevention rather than control that was needed.

A. S. Gunn, A.M.E.I.C., the presiding chairman, on behalf of the members of the branch, thanked the speaker for his timely and interesting address.

The chairman then introduced Earle O. Turner, A.M.E.I.C., Professor of Civil Engineering, University of New Brunswick, who read a very interesting paper on "Highway Development."

Highway Development

The first highway builders on this continent were both engineers and contractors and the first highways were of the trunk line class. Reference is made in the first instance to the North American bison, or buffalo, as they are popularly called. Their immense trails still exist in the west, and can be traced from southern Alberta to Texas. Whether from a streak of laziness or from the real instincts of economic location, their trails followed an even grade from the north to the south and sections of these trails were used by the early settlers and have since been paved. These are perhaps the only highways on this side of the ocean to which no date can be attached.

The early colonization of North America was developed by means of waterways and the Indian method of travel by canoe and portage. Governments were not sufficiently stable until after the Seven-Years War and the Revolution to undertake any real programme of road development. At the beginning of the nineteenth century, however, real road programmes were carried out in the United States and Upper Canada, and clearing and partial construction of the royal roads in New Brunswick must have been considered in that day a broad and comprehensive scheme of road improvement.

It is quite worthy of note that these nineteenth century highways were of the trunk line type, ranging up to three and four hundred miles in length in some cases. Many of these roads were operated on the toll gate principle, and from that were known as turn-pike roads. Like the European rural roads of that day, they were considered adequate if they were substantial enough to keep horses from miring themselves, and smooth enough to prevent passengers from being thrown from their carriages.

The advent of railway systems in the middle of the last century changed the plan of highway development from the trunk line type to the railway feeder type. The railways were the main arteries of commerce, with the highways becoming of local importance only and administered by municipalities.

The advent of the automobile at the opening of the present century brought an immediate change in highway policy. Provincial and state highway departments were created and the programme of provincial and state highways was begun. Co-operation between provinces and states resulted in a much broader programme of trans-continental highways and trunk lines, and so in the present decade we find ourselves back to the policy of the early 1800's, that of providing the individual the means to travel across the country in his own vehicle.

From the standpoint of speed of travel, the present tourist is far harder to satisfy than his patient ancestor in 1800. His demands have kept the modern highway designer at his wits end to provide satisfactory surfaces and adequate rights of way. Our conception of the proper width of travelled way is now two or three times what it was fifteen years ago. Eighteen feet was then considered an adequate width of pavement. At that time it was possible to build a concrete road without a longitudinal joint, and it was necessary to close the road to travel and to detour all traffic. With cement concrete this would mean a closure of months, as the surface requires time to cure properly. With the advent of super-highways ranging from 30 feet to 100 feet in width, the problem is simplified because the subgrade can be prepared for the full width, travel carried on one-half or one-third and concrete poured on the remainder. When the half or third section is sufficiently cured, travel is turned on it and the remaining section blocked in.

With regard to the matter of dust preventatives or palliatives statistics show that bituminous products have been used for that purpose since the close of the Franco-Prussian war in 1871. The water cart sprinkler, of course, was used before that time, but while water has a proper place in street flushing and cleaning, it is most uneconomical as a dust preventative. Calcium chloride has found favour in recent years as a dust preventative, especially in districts like the maritime provinces, far removed from the oil centres, where the price of oil is excessive. Calcium chloride is easily applied by the dry method and does not involve the overhead expense met with in the case of oil. It also recommends itself to the householder and automobile owner, as it is clean. It has the disadvantage, however, of increasing the softness of the surface as the frost leaves the ground and it does not build up the surface to any extent.

Following Prof. Turner's address, slides were shown depicting various types of highway construction in the United States, each type being described in detail by the speaker. One particularly novel type, which excited considerable interest, was that of a logging road built of 3-inch plank laid on longitudinal timbers. Motor logging trucks using this road carried loads equivalent to that which could be carried by a railway flat car.

A vote of thanks, moved by C. S. G. Rogers, A.M.E.I.C., seconded by G. C. Torrens, A.M.E.I.C., was extended the speaker for his very instructive address.

Annual Meeting

The annual meeting of the branch was held in the chief engineer's office, Canadian National Railways, on May 19th. In the unavoidable absence of the chairman and vice-chairman, C. S. G. Rogers, A.M.E.I.C., was, by vote of the meeting, appointed to the chair. The annual report and financial statement were presented and approved. A letter was read from the retiring chairman, A. S. Gunn, A.M.E.I.C., thanking the members for their co-operation during the past year, and in particular expressing his appreciation of the work done by G. E. Smith, A.M.E.I.C., chairman of the papers committee, and also J. R. Freeman, A.M.E.I.C., and J. H. Whitford, J.E.I.C., of the entertainment committee. The scrutineers appointed by the executive, R. H. Emmerson, A.M.E.I.C., J. R. Freeman, A.M.E.I.C., and James Pullar, A.M.E.I.C., then reported on the count of ballots cast for election of officers for the year 1927-28. The following will hold office for the ensuing year:—

Chairman	G. C. Torrens, A.M.E.I.C.
Vice-Chairman	H. J. Crudge, A.M.E.I.C.
Secretary-Treasurer	V. C. Blackett, A.M.E.I.C.
Committee-men	James Pullar, A.M.E.I.C.
	G. E. Smith, A.M.E.I.C.
	Prof. F. L. West, M.E.I.C.
	E. T. Cain, A.M.E.I.C.
	M. J. Murphy, A.M.E.I.C.
	H. B. Titus, A.M.E.I.C.

Annual Report

The Executive Committee held nine meetings during the year. There were nine meetings of the branch, one of which was open to the public. Papers were read, addresses given and business transacted as follows:—

Meetings

Aug. 13—Meeting held at the Riverdale golf clubhouse, at which R. J. Durley, M.E.I.C., general secretary, gave an address on "Institute Affairs."

Oct. 26—A supper-meeting was held at which K. L. Dawson, A.M.E.I.C., superintendent of the gas plant, Nova Scotia Tramways and Power Company, Halifax, gave an address on "Coal and Other Fuels Derived Therefrom."

Nov. 30—A supper-meeting was held at which Geoffrey Stead, M.E.I.C., district engineer, Department of Public Works, Saint John, N.B., read a paper on the "Richibucto Cape Breakwater."

Jan. 13—A special meeting was held at Mount Allison University, Sackville, N.B. A. F. Dyer, M.E.I.C., chief engineer, Nova Scotia Construction Company, Halifax, gave an address on "Lake Kenogami Storage Dams."

Jan. 26—A supper-meeting was held at which an address on the "Welland Ship Canal" was given by A. J. Grant, M.E.I.C., engineer in charge of the canal.

Mar. 2—A supper-meeting was held at which Prof. H. W. McKiel, M.E.I.C., read a paper, written by D. R. Munro in 1862, on "The Forest and Ornamental Trees of New Brunswick." Coloured transparencies and slides were shown and a lecture in connection with these slides was read by C. S. G. Rogers, A.M.E.I.C. Officers for the year 1927-28 were nominated at this meeting.

Mar. 29—A meeting, open to the public, was held at which John Stephens, M.A.I., M.E.I.C., professor of mechanical engineering, University of New Brunswick, delivered an address on "Gunnery in the Great War from an Engineer's Standpoint."

Apr. 8—A supper-meeting was held at which Thos. J. Locke, district engineer, Department of Public Works, Halifax, read a paper on "Our Maritime Harbours and What They Mean to Us."

Apr. 26—A supper-meeting at which the Hon. C. D. Richards, minister of lands and mines, province of New Brunswick, delivered a very interesting address on "Forest Conservation," and E. O. Turner, B.Sc., A.M.E.I.C., professor of civil engineering, University of New Brunswick, read a paper on "Highway Development."

Notwithstanding the fact that Moncton is somewhat removed from the more populous centres, and the task of obtaining outstanding speakers by no means an easy one, the majority of our meetings have been marked by addresses of particular excellence, and great credit is due G. E. Smith, A.M.E.I.C., chairman of the Papers Committee, for maintaining this high standard.

With one exception, our supper-meetings during the past year were held in the Y.M.C.A., and credit must be given Messrs. J. R. Freeman, A.M.E.I.C., and J. H. Whitford, Jr.E.I.C., for the very satisfactory arrangements made with that institution.

MEMBERSHIP

During the past year our membership has decreased, as shown in the statement below:—

	1925-26	1926-27
Resident—		
Members	9	8
Associate Members	25	21
Juniors	4	5
Students	19	6
Affiliates	1	0
	58	40
Non-Resident—		
Members	2	2
Associate Members	8	9
Juniors	4	2
Students	4	2
	76	55

Moncton Branch lost one of its most prominent members in the sudden death on July 9th, 1926, of J. S. O'Dwyer, M.E.I.C., engineer of right-of-way, Canadian National Railways. Members of the branch also regret the passing of Hugh Jardine, who until a short time before his death was a member of this branch.

The thanks of the executive are due the chairmen of the Papers Committee, the Entertainment Committee, and also those outside our profession who so kindly furnished the musical entertainment for our meetings.

Grateful acknowledgment is made by the secretary of valuable advice and assistance received during the year from M. J. Murphy, A.M.E.I.C., former secretary of the branch.

FINANCIAL STATEMENT

Financial statement for the fiscal year June 1st, 1926, to May 31st, 1927:—

Receipts	
Cash in bank, June 1, 1926	$ 54.43
Cash on hand June 1, 1926	3.57
Rebates on dues	97.50
Branch News	16.58
Bank interest	1.64
Supper-meetings	162.00
Miscellaneous	.30
	$336.02
Expenditures	
Expenses, branch meetings	$202.51
Printing	31.65
Stamps	5.90
Discount on cheques	.60
Telegraph and telephone	3.52
Advertising	3.88
Fraser Floral Co.	10.00
Rae Fraser	18.70
Maritime Professional Meeting	15.00
Miscellaneous	6.07
Cash in bank	38.19
Cash on hand	0.00
	$336.02
Assets	
Balloptican lantern	$ 45.00
Attache case	10.00
Rubber stamp	.50
Cash in bank	38.19
Cash on hand	0.00
	$93.69

Liabilities

None.

Audited and found correct,

M. J. MURPHY, A.M.E.I.C.,
J. D. MCBEATH, M.E.I.C.,
Auditors.

V. C. BLACKETT, A.M.E.I.C., *Secretary-Treasurer.*
A. S. GUNN, A.M.E.I.C., *Chairman.*

Niagara Peninsula Branch

Walter Jackson, M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

VISIT TO HORTON STEEL WORKS

More than a hundred members of the Niagara Branch visited the Horton Steel Works at Bridgeburg on June 15th, and learned somewhat of steelcraft.

Members of Niagara Peninsula Branch

These shops are equipped with most of the devices for pressing, bending and welding the heavy steel plates and shapes which are employed in modern engineering practice.

Steel plates one and one-half inch thick and ten feet square are received from the rolling mills and worked into every imaginable shape and form, rivetted or welded to stiffening angles, and come out in the form of great spheres for gas holders, hemispheres for the bottoms of tanks, penstock tubes for hydro-electric developments, digesters for pulp mills and many other complicated forms.

Most of the individual pieces are so weighty that they have to be handled by cranes, and every machine is equipped with its own electric hoist or electro-magnet that are almost human in gripping and holding the great pieces of steel at just the right angle to be cut by the circular disc shears or pounded by the dishing machine.

It was through the kindness of the general manager, Carl H. Scheman, M.E.I.C., that this visit was arranged, and his kindness did not stop with the inspection of the plant. Bridgeburg was thrown open to the engineers, tennis and lawn bowling courts were invaded by a party under the guidance of Neville Bates, A.M.E.I.C., the Peace bridge was traversed by another group, who had Chief Engineer Edward P. Lupfer and Superintendent R. W. Cady as their guides, and the Erie Downs Golf Club provided entertainment for Scotsmen.

The various groups then joined the golfers at the clubhouse and an excellent dinner was served to the accompaniment of the bagpipes and other incidental music. Prizes for the golf tournament were presented to D. E. O'Brien, M.E.I.C., and Johnny Munroe, who contributed to the gaiety of the evening by a sword dance, and also a highland reel with Mr. Grant as his partner. Wild and woolly western reminiscences were told by Messrs. Tom Scott, Brodie Atkinson, Alex. Milne, A.M.E.I.C., and others, followed by John Sears, who gave a practical demonstration of the evolution of the Charleston, and who deserves special mention.

On motion by Harold Burke, M.E.I.C., and Alex Milne, A.M.E.I.C., the party was voted the success of the season, and the thanks of the branch were whole-heartedly tendered to Chairman Carl Scheman, M.E.I.C., Mr. Mannock, his aide-de-camp, and the Horton Steel Company.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

Ice Engineering

The regular meeting of the Peterborough Branch was held on Thursday, April 28th, 1927, at which Dr. Howard T. Barnes, M.E.I.C., of McGill University, addressed the members on the subject of "Ice Engineering." Dr. Barnes outlined his early work in the investigation of ice problems and described the progress of his investigation and his recent work in combating ice troubles. The address was well illustrated and to the large number of members of The Institute and their friends who were in attendance it proved of great interest.

Annual General Meeting

The annual general meeting of the branch was held on Tuesday, May 17th, 1927, and at this meeting the results of the ballot for the election of officers for the year was announced as follows:—

G. H. Burchill, JR.E.I.C.; A. E. Caddy, M.E.I.C.; W. M. Cruthers, A.M.E.I.C.; A. B. Gates, A.M.E.I.C.; J. A. G. Goulet, M.E.I.C.; P. Manning, A.M.E.I.C.; B. Ottewell, A.M.E.I.C., and W. E. Ross, A.M.E.I.C.

During the counting of the ballots three reels of moving pictures, depicting the lumber industry in Canada, were shown, and following the business part of the meeting refreshments were served and entertainment provided.

Executive Meeting

An executive meeting of the branch was held on Friday, May 20th, at which the new executive selected the following officers and chairmen of committees for the coming year:—

Chairman, A. E. Caddy, M.E.I.C.; secretary, W. E. Ross, A.M.E.I.C.; treasurer, A. B. Gates, A.M.E.I.C., Branch News Editor, B. Ottewell, A.M.E.I.C.; Membership, W. M. Cruthers, A.M.E.I.C.; Meetings and Papers, P. Manning, A.M.E.I.C.; Social, G. H. Burchill, JR.E.I.C.

The ex-officio members of the new executive are:—

R. L. Dobbin, A.M.E.I.C., councillor, and B. L. Barns, A.M.E.I.C., past chairman.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting of the branch was held on Friday, May 27th, 1927, at the Y.W.C.A. rooms, following a dinner at which a number of guests were present. C. H. Speer, M.E.I.C., acted as chairman owing to the absence of G. H. Kohl, M.E.I.C., chairman, and R. S. McCormick, M.E.I.C., vice-chairman. He called the meeting to order and welcomed the guests before disposing of the regular business.

Water Supply in France During the Great War

Mr. B. M. Owen, of Galt, was then called upon and he gave a splendid paper on "The Water Supply in France During the World War." By the use of maps and sketches he put the members right in touch with the actual conditions as existed in Flanders. The increasing value of engineers in war work, he said, was thoroughly demonstrated before the war was finished, and he felt that future armies would be composed almost entirely of engineer specialists corps. The lack of publicity given to remarkable engineering feats during the war was due to such endeavours being considered secondary to actual front line operations, but he pointed out that the vital importance of the water supply to the carrying out of successful operations on the front line depended upon the engineering corps, and they had to work under various handicaps, such as lack of dependable records, especially as to the magnitude of engineering works in the field of previous wars, lack of sufficient skilled mechanics to lay, maintain and operate lines and pumping stations and the constant danger under which they had to work, as they were constantly crossing the shelled areas and had to repair broken pipe lines under the most difficult conditions.

at Horton Steel Works, Bridgeburg, Ont.

It was most important to the army to have water free from germs, and this required close supervision, otherwise disease would have been the greatest enemy of the allies. (The water was chlorinated at point of use and not at source.) He pointed out that in 1914 the equipment for water supply would have been sufficient had the war been one of movement, but as soon as it became one of retreat and siege, the engineers' trouble began in earnest. Special steps had to be taken to augment equipment and special staffs were organized to carry on this work. The Americans adopted similar organizations to the British and Canadians.

A most careful study of northern France and Belgium were made and wells had to be sunk by boring to certain depths and the water either pumped or raised with an air lift mechanism which proved very successful, and one could hardly imagine the great number of types of pumps and machinery that were in use, the English supply had been all used up and consequently any make that could be obtained was used. A standard depth for wells and for pipe laying was at last adopted. The pipes at first were laid eight feet deep, but as that did not afford protection against artillery fire a depth of two feet six inches was used, as this meant less digging for repairs to damaged pipes.

One particular sketch clearly outlined the tremendous amount of piping that had to be installed in order that the army could advance upon a certain date and this work was completed in record time. All through his paper Mr. Owen stressed the point that, for the execution of all army operations, speed was most essential and that this required highly trained engineers.

A most interesting discussion followed this paper, and on motion of C. H. E. Rounthwaite, A.M.E.I.C., and Carl Stenbol, M.E.I.C., a hearty vote of thanks was tendered to Mr. Owen.

Vancouver Branch

F. P. V. Cowley, A.M.E.I.C., Secretary-Treasurer.

On April 13th Mr. C. A. Banks addressed the members of the branch on the development of the British Columbia Silver mine, outlining the work from its initial stages. An abstract of Mr. Banks' paper appears on another page of this issue.

An interesting paper on "The Need of Wider Streets as Developed by Investigation in Cities of America and Europe" was given by W. H. Tiedeman, assistant city engineer of Seattle, at a meeting of the branch on April 27th. Through personal investigation Mr. Tiedeman has accumulated considerable information regarding street conditions in various large cities both in America and in Europe, and his description of conditions in these cities proved most interesting.

At a meeting of the branch on May 4th, the speaker was Professor W. E. Duckering, of the University of British Columbia, and the subject of his address was "Engineering Education." This was the last of a series of eight papers on this subject and the meeting was held jointly with the Association of Professional Engineers of British Columbia. A great deal of discussion took place on the whole series, and resolutions were adopted urging closer co-operation between the university and the engineering bodies.

The members of the branch listened to a very interesting address at a meeting on May 11th, on the subject of the "Britannia Mines." The speaker was Mr. C. P. Browning and the address was in the nature of a sequel to that of Professor Schofield's, which was delivered before the branch on November 10th last.

The Need for Wider Streets as Developed by Investigation in Cities in America and Europe

At a meeting of the Vancouver Branch on April 27th, 1927, W. H. Tiedeman, assistant city engineer of Seattle, addressed the members on the above subject. Mr. Tiedeman chose as the object of his address his aim to convert engineers to the principle of preparation for the future. Enlarging on this, he took his audience with him, country by country, and city by city, throughout his recent trip across America and Europe.

In view of the general interest in this subject the following extracts from Mr. Tiedeman's paper are reproduced:—

St. Paul—A city of 300,000, perhaps rather backward in the matter of wide streets, prevailing width being 66 feet, with some 80 feet. Its one "real" street was 220 feet wide and 2½ miles long.

Chicago—This city is spending much money on street widening, having voted $100,000,000 for traffic needs along the lake front. The city pays 25 to 35 per cent of widening costs. All new plats of subdivisions must show streets 120 feet wide. The handling of traffic in Chicago shows that the easterners obey traffic signals.

Detroit—Laid out in 1805, has many good wide streets, and is making provision for widening in the future. Many of its streets are 150 to 200 feet wide. A check up of its traffic on a busy street showed 52,000 cars passing one spot in one day. The city levies a tax of one mill for the city's share of street widening costs. In the case of streets not being widened at present, a "set back" line is established for future widening.

Cleveland—Was built up with narrow streets, but outside the city the streets are wider.

Pittsburgh—Recently $6,250,000 was voted for street widening and improvement.

Washington—Originally laid out by a Frenchman; enjoys wide streets, the more important ones being 160 feet; the ones of less importance 130 feet, and the least 90 feet wide. From Washington to Baltimore a new road is being laid out 200 feet wide. This city's streets have a fine appearance, owing largely to the fact that there is not a single wire overhead.

Philadelphia, the speaker humorously remarked, has two streets, and all the rest are alleys. The two, with the city hall at the junction, are Broad street, 113 feet wide, and Market street, 100 feet wide.

New York—The traffic problems here are not so acute as in other cities, as the per capita number of cars is smaller, the subways handling the people. Traffic signals are established at every five blocks.

London—The property owners on Regent street have now widened this famous thoroughfare to 90 feet; Kingsway is now widened to 98 feet; the Strand 62 feet; Piccadilly 80 feet; the Mall 160 feet, with a 60-foot roadway. This city has the best maintained streets seen anywhere.

Brussels—As in the case of many of the old cities of the European continent, the original fortifications have been demolished, leaving a wide "ring" about the city, which is now used as a street, that portion not being used for street purposes being laid out in grass and trees for beautification. The "ring" here is 228 feet wide, and the main business street 98 feet.

Hamburg—The Esplanade is 184 feet wide with two 30-foot roadways.

Berlin—The famous Unter den Linden is 204 feet wide, but the speaker was disappointed in its trees, the largest being only 12 inches in diameter.

Vienna—As in Brussels, the "ring" is a beautiful wide street, but the other streets are narrow.

Venice—The City Marvellous! Six hundred blocks; 80,000 people; no street car; no motor car; no cart in the town.

Rome—An experiment is being tried in a "private" road all the way from Milan to Rome, buying the right-of-way and charging tolls.

Paris—The Champ Elysees is a beautifully laid out street 318 feet wide. From the Arc de Triomphe radiate twelve streets varying in width from 126 feet to 240 feet.

Seattle—Special reference to "set back" lines. On streets the standard is to be 108 feet. In the rear of lots where no lanes are provided, set back lines are enforced.

Mr. Tiedeman then showed some three dozen slides of photos taken by himself on his tour, explaining each of them, especially those bearing on more modern western city development.

Technical Publications For Sale

The following volumes of various publications are offered for sale:—

1.—Journal E.I.C., vols. 1-5, cloth binding; vols. 6-9, unbound.
2.—Municipal Engineering, vols. 38-41, half leather binding.
3.—Engineering News, vols. 57-73, half leather; vol. 74, cloth; vol. 75, unbound; vols. 86-90, cloth; vols. 91-97, unbound.
4.—Canadian Engineer, vols. 37-44, cloth; vols. 45-51, unbound.
5.—Engineering Contracting, vols. 28-36, half leather; vols. 53-58, cloth.
6.—Engineering Record, vols. 67-71, half leather; vol. 72, unbound.
7.—The Engineer (London), vols. 119 and 120, cloth.
8.—Transactions, A.S.C.E., vols. 76-81, cloth; vol. 82, paper; vols. 83-88, half leather.
9.—Transactions, Can. Soc. C.E., vols. 20-28, half leather.
10.—Journal Amer. Soc. Engineering Contractors, vols. 1-5, half leather; vols. 6-9, unbound.
11.—Professional Memoirs, vols. 4-6, half leather; vols. 7 and 8, paper.

Price, $100.00 f.o.b. Fredericton, N.B. Apply to C. McN. Steeves, 218 Regent Street, Fredericton, N.B.

Trade Publications

The American Railway Association, signal section, have issued the first pamphlet of a series of twenty-six chapters to be printed on American railway signalling principles and practices. These chapters are being prepared by a committee of the signal section on an educational basis, and when completed will cover twenty-six phases of railway signalling. The chapter just issued is No. 6, dealing with direct current relays.

Preliminary Notice

of Applications for Admission and for Transfer

June 18th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in September 1927.

R. J. Durley, *Secretary*.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ADAMS—PHILIP ERNEST, of Walkerville, Ont., Born at Stowe, Vermont, Oct. 13th, 1886; Educ., B.Sc., Vermont Univ., 1909; 1909 to date, with Canadian Bridge Co., Ltd., as: 1909-14, detailer and checker; 1914-20, i/c dfting room work; 1920-27, designing engr.

References: P. B. Motley, W. A. Duff, G. F. Porter, C. M. Goodrich, F. H. Kester.

BECKER—FRED. A., of Winnipeg, Man., Born at West Lorne, Ont., Jan. 10th, 1897; Educ., B.A.Sc., Univ. of Toronto, 1924; 1 yr. ry. signalling, Mich. Central Ry. Co., Detroit, Mich.; 2 yrs. sales engr., Can. General Electric Co., Toronto and Winnipeg.

References: W. B. Reynolds, J. W. Sanger, E. V. Caton.

DUNCAN—ROBERT, of Montreal, Que., Born at Greenock, Scotland, July 29th, 1900; Educ., 1921-22, Paisley Tech. College; apptce. engr., Rankin & Blackmore, Ltd., Greenock, Sept. 1915-July 1918; H.M. Forces, July 1918-Mch. 1920; dftsman, Rankin & Blackmore, Mch. 1920-Sept. 1921 and July 1922-April 1923; Oct. 1923 to date, dftsman and asst. to H. A. Budden, patent counsel.

References: C. W. Burroughs, R. A. Ross, J. L. Busfield, J. A. Jamieson, H. H. Vaughan.

HANSON—MYRON W., of Pittsburgh, Pa., Born at Montague, Mich., April 21st, 1886; Educ., Civ. Engr., Ohio Northern Univ., 1910; 1910-12, dftsman on mill bldgs. and 6 mos. with erection dept. in field, Am. Bridge Co.; 1912 to date, with Aluminum Co. of America, as: 1912-20, structural designer on mill and office type bldgs., bridges, trestles, towers, tanks, transmission lines, power house, reinforced concrete foundations, etc.; 1920 to date, designing engr. for Aluminum Co. of Am. and subsidiaries; 1918, 1st lieut. engrs., U.S.A.

References: F. H. Kester, G. F. Porter, C. M. Goodrich, A. E. West, S. E. McGorman, F. W. Taylor-Bailey, J. W. Schreiber.

MORRISON—W. S. E., of Esquimalt, B.C., Born at Pinkerton, Ont., July 15th, 1897; Educ., midshipman, Royal Naval Col. of Can., 1916; lieut., Royal Naval Engrg. College, England, 1922; partial junior matric., Ont., 1913; 1918-19, i/c boilers, battleship H.M.S. Royal Sovereign; 1924-25, sr. watchkeeping officer and senior engr. battleship, H.M.S. Empress of India; 1925-27, ch. engr., H.M.C. torpedo boat destroyer, Patrician.

References: T. C. Phillips, G. L. Stephens, C. V. Corless, W. L. Ketchen, G. B. Mitchell.

PORTAS—JOHN, of Montreal, Que., Born at Windsor, England, Dec. 17th, 1896; Educ., B.Sc., London Univ., 1921; June 1915-Dec. 1922, military service, infantry, Indian Army; Jan. 1923-Oct. 1923, detailer, structural steel, Ingalls Iron Works, Birmingham, Ala.; Nov. 1923-Dec. 1924, designer, structural steel, Canadian Vickers, Ltd., Montreal; Jan. to May 1925, asst. general engrg., inc. design of structures, estimating, hydro-electric developments, Montreal Engrg. Co.; May 1925 to date, asst., Monsarrat & Pratley, designing and estimating bridges of various types, i/c design, estimates and checking details of superstructure of Mtl.-S. Shore Bridge.

References: C. N. Monsarrat, P. L. Pratley, F. P. Shearwood, L. R. Wilson, G. A. Gaherty.

TURNBULL—JAMES THOMSON, of Red Head, N.B., Born at Paris, Ont., April 22nd, 1884; Educ., High School and I.C.S.; 1903-05, rodman and transitman, C.P.R., 1906-08, transitman, C.N.R., Cap Rouge to Grand'Mere and Hawkesbury to Owen Sound; 1907, transitman i/c Aroostook Bridge, C.P.R.; 1910-14, right-of-way survey, installation of Fairville and St. Andrews sewerage systems and general survey work under G. G. Murdoch; 1914-16, private practice in St. John with D. R. Smith as surveyors and engrs.; 1918-20, with St. John Drydock Co.; 1920-26, city survey of St. John, East St. John sewerage system, Lancaster highway constrn., under G. G. Murdoch; 1926 to date, District Provincial Highway Engr.

References: G. G. Murdoch, A. Gray, A. G. Tapley, G. G. Hare, G. B. Hughes, R. S. Lea.

WAKEFIELD—WILLIAM EDWARD, of Montreal, Que., Born at Long Eaton, England, May 7th, 1892; Educ., 1909-13, Derby Technical College, mech'l engrg. privileged apptce. Midland Ry. Co., general shops course concurrent with above tech'l training; 1913, test inspector's asst.; 1914-19, overseas with R.E., M.E.F. and Egyptian Ex. Force; 1919, appointed inspector of materials, Midland Ry. Co.; 1920-21, asst. engr. special constrn. work on new water pumping plant, City of Prince Albert, Sask.; 1921-25, ranching in Northern Sask.; 1926 to date, timber tester to Forest Products Labs. of Canada, McGill Univ.

References: E. P. Cameron, J. F. Harkom, S. D. McNab, C. U. Vessot.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

KILBOURN—FREDERICK B., of Westmount, Que., Born at Owen Sound, Ont., Dec. 14th, 1883; Educ., public and high schools and 1 yr. McGill Univ., 1905-06; 1901-02-03, Mtl. L. H. & P. Co. on hydraulic constrn. and operating in electric power generating stations; 1906 to date, with Canada Cement Co., 1906-19 i/c constrn. and operation of No. 1 plant; 1919 to date, general supt. of Company's plants.

References: A. C. Tagge, R. H. Balfour, R. S. Kelsh, A. E. Dubuc, J. A. Duchastel de Montrouge, J. A. Jamieson, W. Kennedy, Jr.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

FIFE—WALTER MAXWELL, of Cambridge, Mass., Born at Peterborough, Ont., June 9th, 1890; Educ., B.Sc., Univ. of Alta., 1913; S.M., Mass. Inst. of Tech. 1922; summers of 1909-10, rodman, City of Edmonton; Aug. 15 to Nov. 30, 1910, instrumentman on D.L.S.; summers of 1911, 12 and 13, detailer, Dom. Bridge Co., Winnipeg; 1913-15, instructor, Univ. of Alberta; 1915 (summer), 2nd asst. D.L.S.; 1919-20, instructor, Univ. of Alta.; 1921-22, asst. prof., Univ. of Alta.; 1922 to date, asst. prof., Mass. Inst. of Technology.

References: A. W. Haddow, R. S. L. Wilson, C. A. Robb, H. P. Keith, C. C. Sutherland, H. B. Dwight, G. E. Bell, C. St. J. Wilson.

HARVEY—OSCAR ROBERT, of Montreal, Que., Born at Lyndhurst, Ont., Oct. 29th, 1891; Educ., matric., Ottawa Collegiate, 1908, normal training, 1 yr., Queen's Univ., 1914-15; 1912, inspector, Saskatoon intercepting sewer system; 1913, electric light plant. Rosetown, Sask.; 1915-19, overseas, captain, Can. Engrs. Tunnelling Co.; 1920-24, cable sales engr., Northern Electric Co.; 1924 to date, manager, radio sales dept. with same company.

References: T. Eardley-Wilmot, N. L. Morgan, W. C. Adams, H. J. Vennes, J. S. Cameron, W. S. Vipond.

KER—MERLE FRANKLIN, of Niagara Falls, Ont., Born at Niagara Falls, Ont., May 23rd, 1894; Educ., B.Sc., Queen's Univ., 1918; engrg. staff, City of Niagara Falls; engrg. staff, G.T.R.; 1919-21, H.E.P.C. lab. dept., field dfting and inspection dept.; 1921 to date, engr. i/c all constrn. Twp. of Stamford.

References: H. L. Bucke, H. G. Acres, A. C. D. Blanchard, T. S. Scott, W. Jackson, R. Hearn, S. R. Frost, J. R. Bond.

LOY—JOHN AUSTIN, of Ottawa, Ont., Born at Valleyfield, Que., May 12th, 1894; Educ., B.Sc., McGill Univ., 1921; May to Sept. 1921, asst. to res. engr., Bathurst Lumber Co.; Oct. 1921 to Feb. 1922, levelman, James Bay extension, T. & N. O. Ry.; March to Aug. 1922, transitman, same work; Sept 1922-March 1923, chief of party, James Bay extension, T. & N. O. Ry.; 1923-24, student engr., Bell Telephone Co.; July 1st, 1925, to date, district plant engr., Ottawa, Bell Telephone Co.

References: G. M. Hudson, A. M. Mackenzie, S. B. Clement, T. L. Watt, R. S. Eadie, J. B. McRae, J. A. H. Henderson.

MOORE—WILLIAM JAMES, of Ottawa, Ont., Born at Brockville, Ont., Feb. 24th, 1891; Educ., 1st yr. arts, King's Univ.; 1910-12, rodman, leveller, divisional clerk, Nat. Trans. Ry.; 1913-20, asst. to dist. engr., Dept. P.W.; 1920 to date, asst. to Mr. H. M. Davy, engr. i/c test borings, D.P.W., Ottawa.

References: H. M. Davy, S. J. Chapleau, C. R. Coutlee, D. W. Jamieson, J. A. Lamoureux, F. G. Smith, R. deB. Corriveau.

REID—ANTHONY MEREDITH, of Toronto, Ont., Born at Uxbridge, Ont., Dec. 24th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1923; 1915-18, lieut. and captain Can. Engrs. in France and Germany; 1920, constrn. work, water power survey, Kerry & Chace, Ltd.; 1921, dfting, Barber, Wynne-Roberts & Seymour; 1922, town planning work, Frank Barber and associates; 1923-25, student engr. constrn., supervisor, etc., Bell Telephone Co.; 1925 to date, div. plant engr., Bell Telephone Co., Toronto.

References: A. M. Mackenzie, C. H. Mitchell, J. G. G. Kerry, H. L. Seymour, A. MacPhail, T. R. Loudon, P. Gillespie.

WILSON—ELDON PARKER, of East Angus, Que., Born at Buckingham, Que., Nov. 7th, 1892; Educ., B.Sc., McGill Univ., 1920; 1916-19, overseas as lieut. and captain in the Canadian Engrs.; 1920 to date, with Brompton Pulp & Paper Co., as follows: 1920-22, outside engr. of technical service dept.; 1923-25, combustion engr.; 1926, design, constrn. and installation of new steam pulverized fuel plant at Brompton, Que.; 1927, supt. of steam power for the company's mills.

References: G. G. Gale, F. O. White, F. A. Combe, G. M. Pitts, J. A. Dickinson, F. A. Anderson.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

HAMEL—JOSEPH ALBERT, of Three Rivers, Que., Born at Three Rivers, March 30th, 1899; Educ., B.Sc., McGill Univ., 1927; four summer vacations on paper mill constrn.; 1924-26, asst. city engr. of Three Rivers, Que.; 1926 to date, professor of science and papermaking, Three Rivers Paper School.

References: H. M. MacKay, E. Brown, G. J. Dodd, C. E. Gelinas, H. Morrissette, B. Grandmont

MacNUTT—ERSKINE K., of Port Alfred, Que., Born at Malpeque, P.E.I., Oct. 4th, 1898; Educ., B.Sc., McGill Univ., 1923; June to Sept. 1923, inspector on street paving, sewers and water for Village of Grosse Pointe Farms, Detroit, Mich.; Oct. 1923 to Jan. 1924, instrumentman on bldg. constrn., Detroit, Mich.; Jan. to May 1924, dftsman with Truscan Steel Co., Detroit; July 1924-July 1925, asst. to res. engr., S. B. Eddy Co., Hull, Que.; Aug. 1925 to date, asst. to res. engr., Port Alfred Pulp & Paper Co., Port Alfred, Que.

References: H. S. Taylor, R. C. McCully, A. A. Richardson, W. S. Lea, R. S. Lea.

— THE —

ENGINEERING JOURNAL

THE JOURNAL OF
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The Purification of Water for Boiler Feed Purposes

A Review of the Various Methods of Water Purification

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All water at some time during its many changes of state exists in the form of vapour in the atmosphere. Lowering temperatures, greatly assisted by finely divided solid matter, such as dust floating in the air, cause the minute particles of water vapour to collect into larger particles that form mist or rain drops. These are precipitated under favourable conditions and reach the earth as rain, sleet or snow.

Such precipitates moving through the air come in contact with, and absorb to a surprising extent, varying quantities of the many gases diffused in the air.

The principal gases are CO_2 and O. Nitrogen and possibly hydrogen sulphide may be absorbed, if present, but for their general effect upon the composition of the water as a whole they may be disregarded.

Because of its acidity due to absorbed CO_2, and its initial freedom from impurities, rain is a tremendously active solvent and quickly takes in all manner of impurities.

As it journeys along the earth's surface, in rivers or percolates into subterranean streams, it picks up and holds in suspension such particles as organic matter, clay, sand, iron and alumina and often sewage and industrial wastes. Without fear or favour, it continues its way dissolving salts of calcium, magnesium and sodium, such as carbonates, bicarbonates, sulphates, chlorides and nitrates. The gases already present assist in the dissolving or combine with newly procured salts or remain in excess as the conditions determine.

For reference and discussion, the principal impurities may be classified as follows:—

I. Suspended Matter.
- (1) Inorganic or mineral.
  - (*a*) Sand and clay.
  - (*b*) Iron and alumina.
- (2) Organic.
  - (*a*) Living organisms.
  - (*b*) Animal matter.
  - (*c*) Sewage.
  - (*d*) Oil.

II. Dissolved Matter.
- (1) Gases.
  - (*a*) Oxygen.
  - (*b*) Nitrogen.
  - (*c*) Carbon dioxide.
  - (*d*) Hydrogen sulphide.
- (2) Solids.
  - (*a*) Salts of calcium and magnesium.
  - (*b*) Salts of sodium and potassium.
  - (*c*) Organic and inorganic iron.
  - (*d*) Manganese and aluminum salts.
  - (*e*) Organic compounds.

From the very beginning of history, water has been universally used in the vital phases of the arts and industries. Many processes have delicate and critical stages where the impurities present in the water cause serious damage and losses.

In boilers, the impurities present in the feed water precipitate as mud, sludge or scale varying in thickness and hardness. These deposits on the wetted side of the heating surface cause the same kind of difficulties as soot deposited on the fire side of the heating surface. They act as insulations and therefore not only cause loss of boiler efficiency and waste of fuel but frequently cause local overheating of the tubes, drums, etc., resulting in bulging, tube blowouts, blisters, etc. The deposits also necessitate frequent boiler shutdowns in order to permit cleaning, which means an idle investment.

As boiler ratings and pressures increase, and more and more heat units are forced through the heating surface into

Figure No. 1.—Sections of Pipes showing Scale.

the water to form steam, the need for scale-free or sludge-free heating surfaces becomes more imperative. Furthermore, the cost of making steam is receiving greater attention to-day than formerly because of the rising costs of fuel and labour, which demands higher efficiency. The labour of cleaning boilers, the value of the fuel wasted by the scale, the cost of tube replacements and other repairs made necessary by scale and the damage frequently resulting from the scale cleaning operation,—all these have naturally created a demand for pure water and have likewise furnished the stimulus for improvements in the art of water purification to provide feed water of higher and higher quality.

The various methods of water purification in use to-day may be classified as follows:—

Removal of suspended matter:—by settling; coagulation and settling; filtration.

Removal of dissolved matter:—(a) *Gases,* by aeration, deaeration, heating; (b) *Dissolved matter:*—distillation; treatment by soluble reagents; contact with the insoluble reagent, zeolite.

Removal of Suspended Matter

Sedimentation alone is effective for the removal of only heavy particles like sand or mud. For finely divided turbidity, colour or organic matter it is customary to employ some coagulant such as alum sulphate or iron sulphate which forms a flocculent precipitate, (floc), that enmeshes these smaller turbidity particles in its midst to permit removal by settling or filtration. Filtration alone, following the application of a coagulant, is used for waters that are not extremely turbid, but in the latter case the use of filters is frequently preceded by the use of a settling tank in which some of the floc, with its enmeshed mud, settles, thus relieving the filters of some of their burden.

The removal of suspended matter alone does not ensure clean boilers, although in the case of fairly soft turbid river waters clarification will help.

There are many clear hard well waters which form very heavy boiler deposits, and therefore it is necessary to remove dissolved matter, both gaseous and solid.

Removal of Dissolved Gases

Gases dissolved in water do not offend so much by forming deposits as by causing objectionable tastes and odours for potable purposes, and by causing corrosion when used for industrial purposes. Malodorous gases like H_2S can best be removed by aeration, which scrubs the objectionable gas out by trickling the water through an atmosphere free from that gas. This, of course, saturates the water with oxygen which does not reduce its corrosive properties.

To remove CO_2 and oxygen for boiler feed purposes where hot water is required anyway, the heating of water by direct contact with steam is the simplest method. As long as such mixing or contact heaters are properly vented to remove the liberated gases and sufficient steam is employed to raise the temperature of the heated water always to the boiling point, the gases are sufficiently removed to protect boilers against corrosion. To protect steel tube economizers, a more perfect gas removal is necessary and special provision must be made for that purpose.

Removal of Dissolved Matter

Distillation

Distillation accomplishes water purification by evaporating it and then condensing the vapour to form distilled water. The vapour as it forms usually leaves behind most of the impurities present in the feed water. Care must be taken that the evaporators are blown down sufficiently and that they are not overloaded, so that the vapour does not entrain too much of the salines. Condenser leakages, whereby the hard cooling water leaks into the condensate, is also a source of contamination of the feed water, so that even evaporator installations may be found which do not keep boilers clean.

Distillation is mainly used on board ships because sea water contains so much sodium salt that there is no other method of water purification by which this salt can be removed. On land, distillation is usually too expensive to be considered in comparison with the other methods which can purify most waters successfully. Furthermore, it is only possible where the per cent of makeup is very small. The operating cost to supply the live steam used and the losses by radiation and leakage make it not only more costly to install but more expensive to operate.

Most industrial plants therefore purify their feed water by other methods, such as treatment with soluble reagents or with the insoluble reagent zeolite. "Soluble Reagent Treatment," which is frequently called "Precipitation Methods," may be external to the boiler or internal. Where internal, the reagent used is usually referred to as *boiler compound.*

Boiler Compounds

A great variety of substances have been employed for this internal treatment. Among them may be mentioned soda ash, caustic soda, barium compounds, graphite, tannin, kerosene, slippery elm, glucose, etc. Proprietary secret compounds are usually made up of a mixture of one or more of these substances. In general, the action of the boiler compounds may be divided into two classes:—

(1) The reduction of hardness by chemical reactions which is exemplified by the use of soda ash and caustic soda.

(2) The mechanical action on the scale with the intention of coating the grains to interfere with their close cementation. This is typified by the use of tannin, graphite, slippery elm.

The claims that the action of the second class of compounds was mechanical rather than chemical had a certain appeal to the early operators, to whom chemistry was somewhat of a mystery. The general failure of such compounds to fulfil the claims made for them has imparted an unscientific atmosphere to the field of internal boiler treatment.

The nature of the chemical reactions with the feed water, however, when boiler compounds of the first class are used is in the same general class with those involved in a precipitation water-softening plant. The important difference is that the precipitates formed by the reactions with the boiler compounds enter the boilers, whereas in the case of the precipitation water-softening plants the precipitates are removed from the water by settling and filtration, only the clear softened water entering the boilers.

The boiler compound advocate makes three claims:—First, that the resultant precipitates form a sludge inside the boilers less compact than the scale formed by the hard water, and that therefore the first cost of investment in settling tanks and filters may be saved by using the boiler itself as a settling basin. Second, more accurate proportioning of the chemicals is accomplished than in precipitation plants. Third, boiler compounds save the loss of water wasted in washing filters and sludging off settling tanks of precipitation plants.

In answer to these claims, the following considerations must be taken into account:—Sludge in a boiler will accumulate and will bake together into a hard layer, and the reagents added in general increase the amounts of deposits and the burden of solid content which the boiler has to bear. To maintain the high boiler efficiency to which modern power plant practice has attained, it is essential to maintain the heating surface absolutely clean both inside and outside. It is just as necessary to prevent sludge accumulating on the wet side of the heating surface as it is to keep soot off the dry side. If efficiency is not a consideration, if labour for cleaning is negligibly cheap, and if fuel is plentiful and extremely low in price, then the use of boiler compounds may be permitted, but these conditions no longer exist, although they may have been found formerly.

Regarding the second claim, the greater accuracy of proportioning, this is difficult to substantiate. The same problem exists in both cases of adding definite amounts of certain chemicals in accordance with the composition of the incoming water and also the proportioning of volume of chemical solution to the volume of water to be treated. A general inspection of the usual boiler compound feeding devices and of the precipitation plant chemical feed controls will disclose a contrast in favour of the latter from the point of view of refinement, mechanical ingenuity and reliability of action. Furthermore, it is possible to check up the results of treating a water in precipitation water softeners by analyzing the effluent before it enters the boiler and so adjust the treatment until the desired results are obtained. By using boiler compounds, it is possible to check the efficacy of the dosage only by inspecting the boilers after they are taken " off the line."

The third claim is correct, but offsetting it is the loss of heat in the water blown off from the boiler. If the boiler is to receive the precipitates, and the sludge formed by the boiler compound is not to accumulate, it must be blown off. The heat loss in the blowoff water above 350° F. required to sludge off the boiler is one of the most serious penalties incurred by the use of the boiler itself as the precipitation tank.

Precipitation Water Softeners

Precipitation water softeners embody the main principle of adding prescribed amounts of definite soluble chemicals, usually lime and soda ash, to react with the hardening compounds of the raw water.

There are two main divisions of precipitation plants, namely, intermittent and continuous. The former consists of two or more settling tanks, one filling and receiving its charge of chemicals, while the other is being used to deliver treated water to service. In this way each tank goes through a cycle of operations,—filling, charging, agitating, quiescent settling and finally emptying. The continuous plants usually have one settling basin, and the water flows continuously from inlet to outlet, receiving the charge at the inlet, settling as it flows and after filtering leaves at the outlet completely treated.

Intermittent plants are preferred for the treatment of waters which vary in composition between wide limits, because the average composition of water in a full tank can be determined irrespective of the variations that may have taken place as the tank was being filled.

Some continuous plants have heaters ahead of the settling tanks and permit the reactions and settling to take place at boiling temperature. Although this gives a resulting effluent of lower hardness and a smaller settling tank is permissible because of more rapid reactions, the loss of heat by radiation from the settling tanks and filters and also by losing hot water in sludging off and washing of filters must be considered.

In the operation of precipitation plants, it is necessary to make a chemical analysis of the raw water to obtain the correct charge of lime and soda ash or other reagents to react with the varying composition of the raw water. Many water supplies are drawn from surface sources, such as rivers or ponds. The volume of water in these supplies varies with the seasons and with the rainfall. Sudden storms have been known to change the mineral content of a stream completely in a few hours. If too little chemical is added to the water the hardness is incompletely reduced and if too much chemical is added an objectionable amount of the excess of chemicals is left in the treated water. The addition of too great an excess of lime may even form a harder water than the original supply, since lime, besides being caustic, is also a form of hardness. The operator must therefore be alert and skilled to control the treatment properly.

Besides the need of skilled supervision to apportion the chemical dosage to suit the composition of the raw water, there are various mechanical problems to solve. Sludge disposal from the settling tanks frequently clogs sewers, and some city ordinances prohibit dumping sludge into sewers on this account. This frequently entails sludge collection in pits and removal by digging out periodically and carting away to disposal dumps. The mechanical problem also exists of feeding the chemicals at a rate in proportion to the rate of the raw water flow. This involves a form of meter for the water and a meter for the chemicals. Since the chemicals are usually fed in the form of a suspension of particles, or a " milk," the meter itself may become coated with the particles with the resultant change in the rate of chemical dosage. The complexity of this chemical feed problem, from the mechanical point of view, is evidenced by the many hundreds of devices that have been developed and patented to date.

This covers in general the methods of treatment employing soluble reagents as a means of softening. These means have their definite limits, for at best the soluble reagent apparatus provides a water containing considerable amounts of the reagents in addition to certain residual quantities of the original hardness. This hardness may amount to 4 to 5 grains per United States gallon in the cold and 2½ to 3 grains at boiling temperature.

Zeolite Water Softeners

Zeolite plants accomplish the removal of the hardness by percolation of the water through a bed of zeolite material suitably supported and distributed in a container with piping and valves attached to properly distribute and control the flow of water. The hardness is removed from the water by the well known base exchange principle, the zeolite exchanging its sodium base for the calcium and magnesium bases in the water. A meter is provided to indicate when the softener has passed the quantity of water it was designed to soften. The zeolite bed is then automatically regenerated or revivified by passing a solution of salt, (common brine), through the softener. The brine by a reverse exchange reaction gives its sodium base to the zeolite, and as

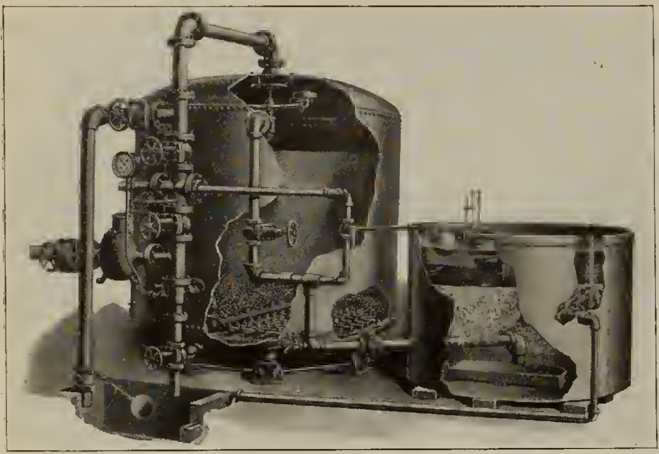


Figure No. 2.—Permutit Vertical Zeolite Water Softener.

it leaves the softener it carries with it in a clear solution the calcium and magnesium extracted from the zeolite. The zeolite is then rinsed free of brine and the softener is again thrown into service by opening the necessary valves.

The term " zeolite " was originally a mineralogical term only,—for a family of well defined hydrous silicates. The term is derived from a combination of two Greek words meaning " to boil " and " stone," and the name was given to this mineralogical family because when a blow pipe is applied most zeolites swell or boil up in a characteristic way. To-day the name " zeolite " is applied not only to this family of minerals but also to all base exchange silicates not classed as " zeolites " in mineralogy but which are used in water softening. The synonymous usage of these terms " zeolite " and " base exchange silicates " had its origin in the chemistry of soils.

Summary of Work of Chemists on Zeolites

In 1850 and 1852, J. Thomas Way, an English chemist, published two articles relating to experiments which he had made with soils. He found that soils possessed the power of separating bases from salts dissolved in water, and that the action " was rapid, if not instantaneous " similar to the reaction between an acid and a base. He assumed that there might be certain silicates in the soils to which this peculiar power was due, although he could not isolate these assumed silicates. However, by precipitation, he artificially prepared a silicate which had the properties he had previously found in the soils, thus proving the correctness of his assumption.

Eichhorn, in 1858, investigated certain mineralogical crystalline zeolites having a composition similar to the silicates artificially prepared by Way. He made his experiments with the zeolites chabazite and natrolite, and found that these minerals had the same base separating properties as Way's silicates, and in addition he found that the process could be reversed, *i.e.,* that the zeolite by base exchange reactions could be reconverted or regenerated to its original state. This latter fact was unknown to Way, who had assumed that lime could replace sodium in the silicate but that the lime taken up by the silicate could not be exchanged again for sodium. Later on, in 1871, Knop made similar experiments and found that the exchange properties were not limited to the hydrous *alumino* silicates. He produced hydrous *iron* silicates artificially which had the same properties as Way's alumino silicates and Eichhorn's mineralogical zeolites.

Since Eichhorn's discovery, it has been customary to call the base exchange property a " zeolite " property and to speak of the " zeolites of the soil," even though no appreciable quantity of crystalline zeolite has as yet been detected in the soils to explain its power of exchange reaction.

No practical use was made of the base exchange properties of these silicates before the twentieth century. Then geologists began to attribute certain alterations of rock to the reactions of such silicates, and later Harm and Rumpler, two chemists, suggested the use of such base exchange silicates for the purification of sugar juices. However, their experiments proved to be failures. Subsequently, Gans suggested the use of base exchange silicates for water softening purposes, and after considerable work he succeeded in developing the present zeolite method of water softening, as well as the successful zeolite apparatus.

Base exchange silicates used in water softening are generally called " zeolites " following the usage of the word in soil chemistry, so that to-day the terms " zeolite " and " base exchange silicates " are used synonymously, irrespective of whether or not the zeolite used is a crystalline zeolite in the mineralogical sense or whether it is a non-crystalline alumino or iron silicate or a combination of both.

How Zeolites Soften Water

On passing hard water containing either temporary, (carbonate), or permanent, (sulphate or chloride), hardness through a bed of zeolites the hardness is removed according to the following reactions, in which *Ze* represents zeolite:—

$$Na_2.Ze + Ca\ (HCO_3)_2 = Ca.Ze + 2NaHCO_3$$

(removal of *Ca* bicarbonate)

$$Na_2.Ze + MgSO_4 = Mg.Ze + Na_2\ SO_4$$

(removal *Mg* sulphate).

When the zeolite has exchanged its available sodium for calcium and magnesium it is regenerated by a reverse of the water softening process, thus:—

$$Ca.Ze + 2\ NaCl = Na_2\ Ze + CaCl_2$$

$$Mg.Ze + 2\ NaCl = Na_2\ Ze + MgCl_2$$

Zeolites Classified by Physical Structure

The different types of zeolites vary in their softening capacity, the time required to completely exhaust and to completely regenerate them and the amount of salt to regenerate them. To explain these differences, the zeolites used to-day may be classified for practical purposes on the basis of their physical structure into the following two groups:—(a) porous zeolites; (b) practically non-porous or solid zeolites.

Figure No. 3.—Plant at Birmingham, N.J.—Method of Selection of Zeolite by Hand.

The grains of the first group are, as the name implies, filled with minute microscopic holes or passages of capillary proportions. These are not apparent to the naked eye, but are made readily visible by the application of a dye-stuff. The porous grain absorbs the dye very much like blotting paper, so that the entire granule becomes thoroughly saturated with the colour.

To this first group belong the so-called "artificial" zeolites, whether made by fusing the ingredients together in a typical glass furnace and then hydrating and leaching or by a precipitation process. Whether they contain aluminum or iron as a constituent is of no importance. The so-called "natural" zeolites made from clay that is passed through a series of artificial operations, such as shaping, baking and hydration, also belong to this porous group.

The grains of the second group are practically non-porous or solid. They do not absorb an appreciable amount of water into the interior of the grain. They are like tiny pebbles, and the contact of the water with the zeolite is practically restricted to their outside surfaces. To this second group belong the zeolites consisting of glauconite.

All zeolites have about the same specific gravity, 2.0 to 2.4, but the zeolites of the first group by reason of their porosity weigh less per cubic foot than the more solid zeolites of the second group. The various porous zeolites when in a moist condition weigh from 55 pounds or even less up to 70 pounds per cubic foot, according to their porosity. They contain water up to 50 per cent of the total weight. The non-porous zeolites in the moist condition weigh about 100 pounds per cubic foot and the amount of water contained is generally below 10 per cent of the total weight. The moisture content greatly affects the weight per unit of volume, but does not affect the volume itself. It is for that reason that the purchasers should always insist on buying zeolite by volume rather than by weight.

Zeolites are hydrous silicates, *i.e.,* they contain water which cannot be driven off by heating them to a constant weight at 100 or 105° C. The water remaining at that temperature is often called water of hydration or water of constitution. The higher the amount of this residual water, the greater is the porosity of the zeolite and the greater the total exchange power of the zeolite.

Base Exchange Power Between Regenerations

The base exchange power between regenerations means the total number of grains of hardness, usually expressed as calcium carbonate, which a cubic foot of zeolite absorbs or exchanges up to the point when *zero-hardness* water is no longer produced. This may be called the *softening capacity* of the zeolite and must not be confused with the *total exchange* power. When the softened water first begins to come through the softener with a little hardness in it, it is time to regenerate. That is the practical end-point of a softener's run, because the function of the zeolite softener is to produce nothing but *zero hardness water.* After this point is passed, the zeolite still has base-exchange power left, and considerable additional water can pass through in a partially softened condition before the water emerges with the same hardness with which it entered.

The base-exchange power or water softening capacity is directly proportionate to the active surface of the zeolite in contact with the water. Since the porous zeolites have an active interior as well as an exterior surface, it would naturally be expected to have greater water softening capacity than the solid zeolites. The facts fulfil this expectation.

The softening capacity of a practically non-porous zeolite of about ½-mm. grain size is about 2,500 to 3,000 grains as $CaCO_3$ per cubic foot, and with increasing porosity the capacity of the more porous zeolite increased to 10,000 grains as $CaCO_3$ per cubic foot and higher. These figures are average values influenced to some extent by the water composition, rate of softening and amount of salt employed in regeneration and rate of regeneration. This means, from the practical point of view, that the amount of solid zeolites must be larger if they are expected to do the same work between regeneration as the porous ones.

Rate of Softening and Rate of Regeneration

The higher water softening capacity between regenerations of the porous zeolites can only be obtained by bringing the interior surfaces into action. The internal active surface of the porous grains are harder to reach than the external surfaces of the solid granules. The grain of a porous zeolite may be compared to a capillary tube, whereas the solid zeolite may be represented by a solid rod. In order to make contact with or sweep over the inner surface of the capillary tube, it is necessary to displace the liquid contained within. It is well known that capillary tubes hold liquid by adhesion against the force of gravity and time must elapse before the contents are displaced. On the other hand, to pass the liquid over the external surfaces of the solid rod or the outside surfaces of the capillary tubes takes comparatively little time. This holds true with the water softening reaction as well as the reverse reaction or regeneration. Likewise, it is possible to utilize quickly the outside surfaces only of porous zeolites.

Usually the time employed to exhaust a bed of zeolite is 6 to 12 hours, depending upon the convenience of the local plant and the length of the labour shifts. It is possible to exhaust the water softener capacity of the zeolite bed in as low as 2 hours without decreasing its capacity, but the greater amount of water used in washing and rinsing and the greater amount of labour required to regenerate the plant so frequently must be balanced against the lower cost of the smaller softener which a 2-hour run would permit.

During regeneration the brine must penetrate to the inner surfaces to bring out the calcium and magnesium previously removed, and it takes more time and brine to do this than to brush by the external surfaces. Thus, the solid zeolites and the outside surfaces of the porous zeolites can be regenerated in 20 to 30 minutes, whereas the interior surfaces of the porous zeolites may require one or more hours.

The porous zeolites are usually larger in grain size than the non-porous zeolites. This gives the latter somewhat more external surface area for the same volume of material, but if the porous zeolites are reduced to the same grain size as the solid zeolite and only the external surfaces were called into action, both types of zeolites will act at the same rate and produce that amount of soft water which corresponds to their exterior surfaces. The delay in bringing the liquid in contact with interior surfaces causes the delay in utilizing them.

Thus, all zeolites act instantaneously. It is not the stuff of which the solid zeolite is made or the way it is processed which makes it a "rapid-rate" material, it is merely the physical arrangement of the active reacting surfaces on the outside of the grain.

The salt requirements may vary, since, as explained above, the brine must overcome the adhesive power of the capillary passages of the porous zeolites, considerably more brine is used to accomplish a complete regeneration. If regenerated in the same way, the porous zeolites require about twice as much salt per kilograin, (1,000 grains), removed, as the non-porous. However, the brine that slips

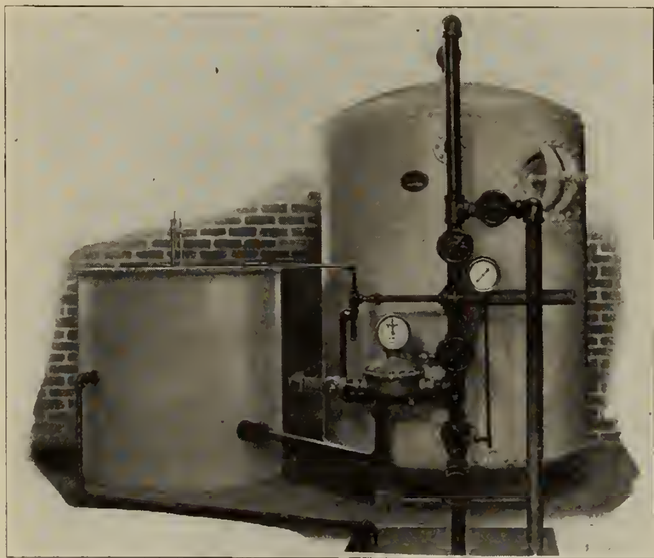


Figure No. 4.—Equipment at Elmhurst Laundry, Elmhurst, Ill.

by unconsumed can be recovered and utilized again. This is the basis of the recovery method of the regeneration which was invented several years ago. With this recovery method the porous zeolites can be regenerated with the same net amonunt of salt as the non-porous, namely, about one-half pound of salt per kilograin of hardness removed, expressed as $CaCO_3$.

In general, the porous zeolites are used advantageously for hard, clear waters, such as well waters. It is essential that the porous zeolites receive clear water, because the inner passages must be kept clean and accessible. Mud or suspended matter in general would clog these passages and then the porous zeolite would become non-porous.

The solid zeolites are adapted to waters of medium hardness that are not always crystal clear, such as the river and lake waters. These zeolites can handle slight amounts of turbidity without loss of efficiency if sufficiently back-washed after each softening run and only require clarifying filters to precede them if the hard water is muddy continuously. Both types of zeolite have their field of application, and equal success can be enjoyed with either porous or the solid zeolites if they are utilized correctly.

Operation of Zeolite Water-Softener Plants

The operation of zeolite water softeners marks a radical departure from the precipitation process. The water is distributed uniformly through the zeolite apparatus, and in its passage through the bed of zeolite the hardness is completely removed. No sludge is formed and no problem of sludge disposal exists. No chemicals are added, and the mechanical problem of controlling the feed of chemicals is avoided. The zeolite, an insoluble reagent, reacts completely with the relatively small quantity of the salts of calcium and magnesium in the water.

The fact that the zeolite is insoluble makes possible this complete removal of the hardness from the water without the possibility of there being an excess of reagent in the softened water. The volume of the zeolite used is greatly in excess of the theoretical quantity required for the reaction, and thus by mass action drives the chemical exchange,—*i.e.,* the softening action,—to the point of zero hardness water.

The capacity of a zeolite softener plant varies approximately in inverse proportion with the hardness of the raw water.

Comparison of Results of Zeolite and Lime Soda

Precipitation plants reduce the hardness of the water to 4 or 5 grains per gallon in the cold and 2½ or 3 grains at boiling temperature. This is due to the character of the reagents used and to the resulting reactions. In order to drive any chemical reaction to its limit, an excess of the reagents is required, but, since lime and soda ash are soluble, this excess is found in solution in the treated water, and, if too great, renders the treated water unfit for industrial or domestic use. Furthermore, some waters offer great resistance to the action of reagents. The resultant precipitates, calcium carbonate and magnesium hydroxide, sometimes form very slowly and remain in a colloidal condition, and thus slip through the filters into the service lines. In the Engineering News Record of January 13th, 1920, this colloidal condition is reported in connection with the municipal precipitation plant of the city of Columbus, Ohio. A hardness of 100 p.p.m., or 6 grains per gallon, was found present in the softened water as a result of this colloidal condition. The precipitates themselves are also soluble to the extent of several grains per gallon, so that it is impossible, even if the reactions could be driven to completion, to produce zero hardness water by the precipitation process.

The relative cost of the reagents used in the treatment by the precipitation and zeolite processes depends on the local market prices of hydrate of lime, soda ash, salt, and also on the composition of the raw water.

The market prices to-day average about ¾ cent per pound for hydrate of lime, 2½ cents per pound for soda ash and 4/10 cent per pound for salt. One pound of hydrate of lime added to 1,000 gallons will react with about 8 grains per gallon of temporary hardness. One pound of soda ash added to 1,000 gallons will react with about 6 grains per gallon of permanent hardness. One pound of salt will regenerate a volume of zeolite that has softened a thousand gallons of water containing about 2 grains per gallon of either temporary or permanent hardness. Therefore, for temporary hardness, one pound lime at ¾ cent reacts with 8 grains, or about 1/10 cent per grain; one pound salt at 4/10 cent reacts with 2 grains, or about 2/10 cent per grain. Lime treatment is therefore half as costly as zeolite softening for temporary hardness. For permanent hardness, one pound soda ash at 2½ cents reacts with 6 grains, or about 4/10 cent per grain; one pound salt at 4/10 cent reacts with 2 grains, or about 2/10 cent per grain. Soda ash treatment is therefore twice as costly as zeolite softening for permanent hardness. Waters which contain equal amounts of temporary and permanent hardness can be treated at the same cost by either method. But as the permanent hardness rises in proportion to the temporary hardness present, softening becomes more economical by the zeolite process.

In making the above calculations, no account has been taken of the fact that softening with lime and soda ash leaves 4 to 5 grains of hardness in the treated water. For example, if the raw water has an average of 14 grains per gallon of hardness, of which 8 grains may be temporary and 6 grains permanent, the lime and soda ash cost of treatment is about 3¼ cents per thousand gallons. But if 4 grains are left in the soft water, only 10 grains have been removed, so that per grain of hardness removed the cost is 0.325 cent. The same water would be totally softened by the zeolite process for about 2.8 cents per thousand gallons, which establishes a cost of 0.2 cent per grain of hardness removed.

There are cases when the *combination* of the precipitation and zeolite process is economical. Waters containing extremely high amounts of temporary hardness,—for example, more than 25 grains per gallon,—and at the same time containing relatively low amounts of permanent hardness,—say, less than 10 grains per gallon,—are economically treated as far as cost of chemicals are concerned by using lime and soda ash. If in such cases the volume of water to be treated is fairly large, the most economical treatment is obtained by combining the precipitation and zeolite processes, using the lime to reduce the temporary hardness and the zeolite to remove the permanent hardness and to finish the incomplete work of the lime. Thus, one can select what is advantageous from both processes and at the same time produce a water of zero hardness. This also insures the reduction of the total solids of the water by the precipitation and removal of the greater part of the bicarbonates or temporary hardness. A number of combined lime-zeolite plants of this nature have been in operation in the United States for many years.

A question frequently raised is the relative influence of various factors on foaming. It is wrongly claimed that zeolite softened water caused boilers to foam on the consideration that the sodium salts have a heavier molecular weight by about 5 per cent than the corresponding calcium or magnesium salts. This is a chemical super-refinement, inasmuch as the usual control of the boiler blowoff to maintain the concentrations of total solids below the foaming limit is not accurate within 5 per cent.

Furthermore, it must be remembered that the water in a boiler, fed with zero water is clear and free from particles of suspended scale and sludge or mud, and experience proves that the tendency to foaming is greatly increased by the presence of such suspended matter. This is illustrated by the fact that when scaled boilers are suddenly fed with softened water the scale which is loosened by the action of the soft water forms just such a suspension of particles,

Figure No. 5.—Central Station Installation in Europe.

Figure No. 6.—Installation at Jefferson Woollen Mills, Knoxville, Tenn.

and for a short period it is necessary to blow off freely to avoid foaming. As soon as the boilers are thoroughly clean, however, they remain clean thereafter and the water inside the boiler clears up and the foaming ceases. A regular blowoff schedule can then be worked out to suit the operating conditions of the boilers, taking cognizance of the steam disengaging velocity and design of the boiler, all of which influence the limiting concentration of the boiler salines. Testing blowoff water with hydrometers should also be made standard practice to check up on the blowoff schedule.

Oil, organic and saponifiable matters are especially provocative of foaming. This is illustrated by a plant which used zeolite softened water in boilers of 1,000 h.p. at high ratings with a water containing 25 grains per gallon total solids. No foaming was experienced during the summer on 100 per cent make-up, but in winter, when returns of 50 per cent from a heating system were used, foaming was observed. The returns lowered the solids in solution, but contained oily sludge previously deposited. As the heating system cleared this winter foaming disappeared.

There is a real need of zero hardness boiler feed water. It is sometimes claimed that a feed water containing as much as 4 or 5 grains of hardness per gallon does not form a sufficient deposit in boilers to warrant consideration. Practical experience, however, proves that such a water is not satisfactory for boiler feed purposes.

The tendency to-day toward boilers of increasing size, operating with automatic stokers at 200 to 400 per cent of normal rating and at very high pressures and superheat, has developed an entirely new set of conditions. Such immense boilers cannot be thrown off the line for repairs with the ease of former days. They are expected to run continuously for considerable periods without shut-down. What was good enough ten years ago with small boilers at low ratings, low pressures and low efficiency can no longer be countenanced. A water containing 5 or 6 grains per gallon of hardness, in a 1,000-h.p. boiler running at 300 per cent rating, deposits in one day 220 pounds of scale on the inside of the boiler. In ten days more than a ton of scale would coat the heating surfaces. This certainly is not "good enough." The limit of hardness in the feed water must obviously be reduced to zero.

The zeolite method of water softening supplies this need for zero hardness water not only for boilers but for general industrial process water.

Further Economy in Steam Generation

A Consideration of Steam Generating Plants Designed to Burn Pulverized Coal and Wood Refuse

E. V. Ahara.
Combustion Engineering Corporation, Limited.

Paper read before the Sault Ste. Marie Branch of The Engineering Institute of Canada, February 25th, 1927

Steam generating plants designed to burn pulverized coal and wood refuse are to be found frequently in this country, particularly in the pulp and paper industry; and, in large plants, the co-ordination of coal and wood refuse fired boiler equipment to produce, as a combination, the most economical overall results, is becoming an interesting problem.

The use of pulverized coal as a fuel is no longer in an experimental stage, but is being accepted as a tried system by industrial plants. As an incentive for the development of pulverized fuel systems, Canada possesses a wide variety of coals. In the Maritime provinces there are high sulphur coals of good heating value, but with low fusing characteristics; in Ontario, standard American bituminous coals are burned; on the prairies, sub-bituminous coals and lignites predominate; and in British Columbia excellent bituminous coking coals are available. It has been found that while these coals have widely different characteristics and heating values, all can be burned with high efficiencies in pulverized form, provided, of course, the equipment is properly designed for the conditions to be met. The ability of pulverized fuel systems to burn with maximum efficiency low grade coals, and also a variety of coals, is considered by many to be an outstanding advantage as far as Canadian industrial plants are concerned.

Assuming that all equipment operates in a reliable manner, the chief problem in boiler plant design resolves itself into a consideration of the principle of heat transfer, —the transfer of B.t.u.'s from the coal to the water. Several items, of course, such as capital costs of equipment, maintenance and depreciation, labour, power, etc., are important. In the great majority of steam plants, however, more than two-thirds of the total annual charges are attributable to coal, and consequently any further developments in steam plant design which will minimize the number of B.t.u.'s thrown away must at least be given thorough consideration.

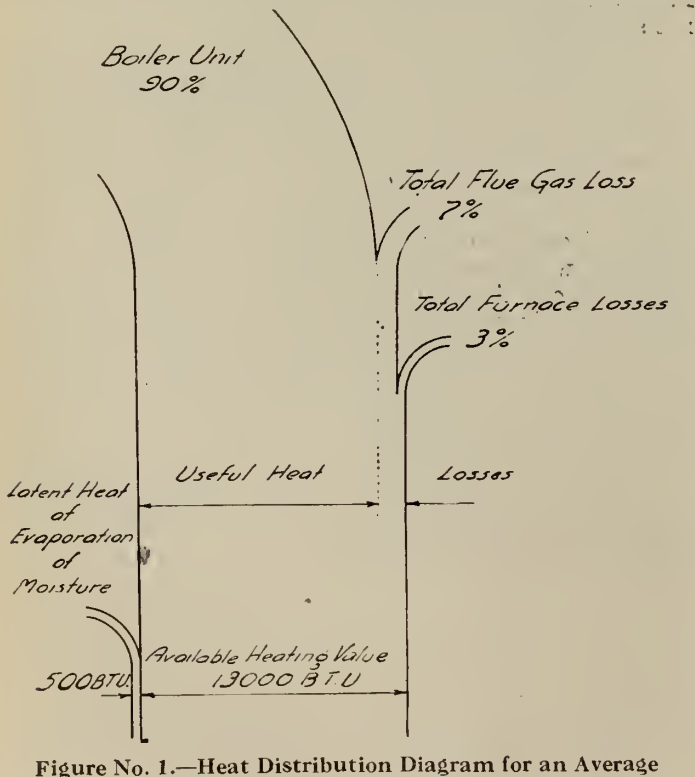


Figure No. 1.—Heat Distribution Diagram for an Average Boiler Plant.

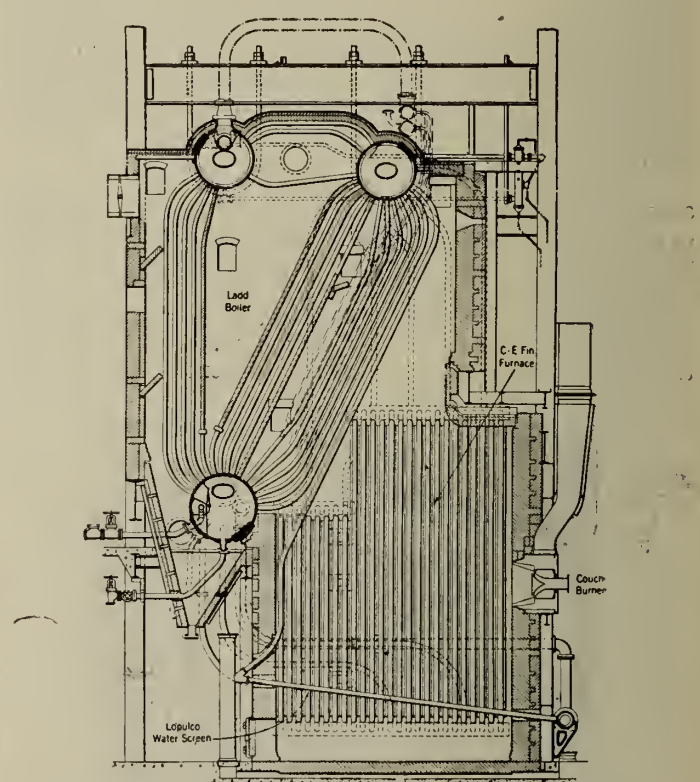


Figure No. 2.—Section through the Boiler and Furnace of a Typical Fuel-Fired Plant.

The channels through which heat is transferred from the coal either to the water in the boiler, or, in the case of losses, eventually to the atmosphere, are as follows:—

- Heat used to evaporate moisture.
- Heat lost in combustible gases.
- Heat lost in combustible solids and sensible heat in solids.
- Radiation from the complete installation.
- Heat lost in flue gases.
- Heat usefully transferred.

The heat which is lost in combustible gases need not evaporate moisture, should not truly be considered as a loss. All coal contains a certain amount of water and a certain amount of hydrogen which, upon uniting with oxygen, will produce water. All of this water must be evaporated and the steam formed must be raised to the temperature of the products of combustion. The heat necessary to increase the temperature of the steam from the temperature at which the fuel enters the furnace to the temperature of the products of combustion can be recovered as the gases cool, but the latent heat necessary to turn the water into steam never can be recovered unless the water in the flue gases is again condensed. This, of course, is not done, and the latent heat, therefore, need not be considered as a loss; rather, it is a factor which decreases the available heating value of the fuel.

An average fuel having a 13,500 B.t.u. content may contain a total combined and uncombined hydrogen content of 5.5 per cent which, when brought into contact with oxygen, will produce about 0.5 pounds of water. This water for its evaporation will require 500 B.t.u.'s, and the available heating value of the fuel will have been reduced from 13,500 to 13,000 B.t.u.'s.

The heat which is lost on combustible gases need not be great; in fact, it is not uncommon to find it completely eliminated. In order to accomplish this, it is necessary simply to effect an intimate mixing of the gases with the air and to provide a suitable temperature and furnace volume for their complete combustion. The present tendency towards turbulent mixing of the gases in the furnace should be of assistance in this respect, and no trouble should be experienced in future in eliminating the combustible gas loss.

The heat loss in combustible solids usually averages from one to two per cent, although in the more carefully operated plants one per cent is seldom exceeded. When it occurs, the greater part of this loss is due to those fine particles of coal which are carried up the stack by the draught before they have had time to burn completely. The ash pit loss in a well operated system of the usual good design should be negligible.

The loss due to radiation varies widely with the type of furnace in which the fuel is burned. In solid wall furnaces, the temperature of the refractory approaches the temperature of the flame in the furnace, and, even if the furnace is well insulated, a radiation loss of approximately four per cent will occur. If the walls are air cooled, this condition will be considerably improved, and, if they are water cooled, the radiation loss can be reduced readily to less than two per cent. It is difficult to give definite figures for radiation, as they vary with the size of the unit, the efficiency of the insulation and the temperature and circulation of air in the boiler room. Further, as the rating increases the amount of heat liberated in the furnace increases much more rapidly than the furnace temperature, and hence more rapidly than the radiation. At high ratings, therefore, the radiation as a percentage loss is reduced.

At this point, emphasis should be laid upon the fact that the above mentioned losses can be minimized only if the furnace itself and the method of firing coal into the furnace, besides being carefully designed, are carefully coordinated.

The fineness of the coal, the general burner design, the intimacy with which the coal and air are mixed at all stages of combustion, the temperature of combustion, the size and shape of the furnace, and the extent of the water wall surface, all have a bearing upon each other. They must be considered both individually and as a composite problem if the desired result is to be obtained.

In addition to the combustible and radiation losses, there is to be considered the sensible heat carried away with the flue gases. The minimum exit flue gas temperature is somtimes limited by the cost of the heat absorbing equipment, sometimes by the condensation of moisture in the flue gas, and sometimes by the high temperature of the feed water and the lack of use for preheated air. In the average well designed installation it is usual to find the flue gases leaving the economizer at a temperature of 300° F., and in such installations the total flue gas loss amounts to about seven per cent.

The writer recognizes the fact that the above outline of heat losses is rather elementary, but it has been given in order to emphasize the single point that if additional increases in efficiency are to be obtained in modern steam

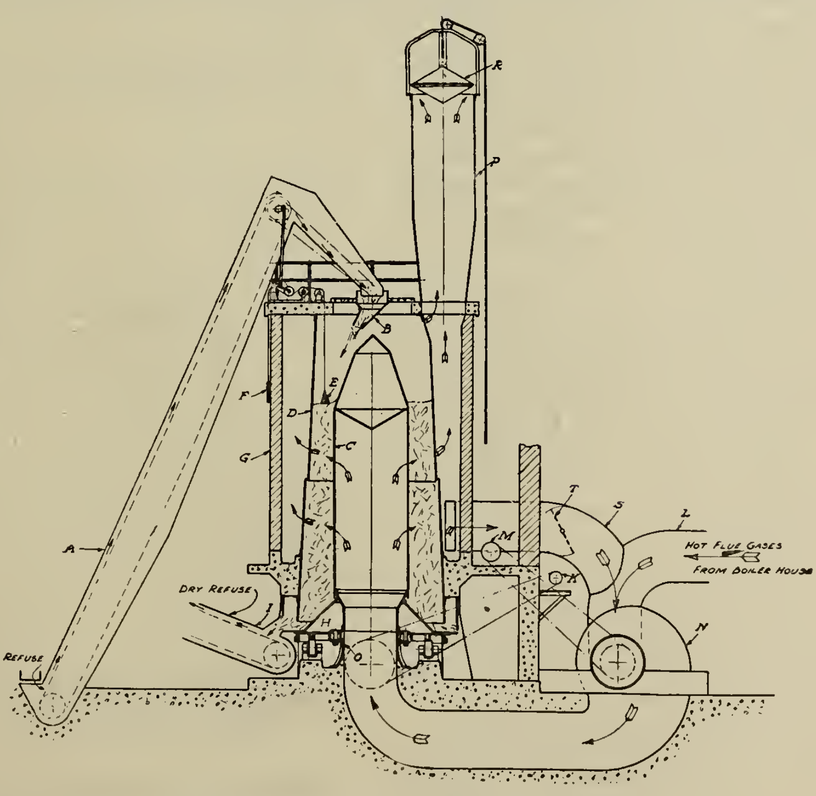
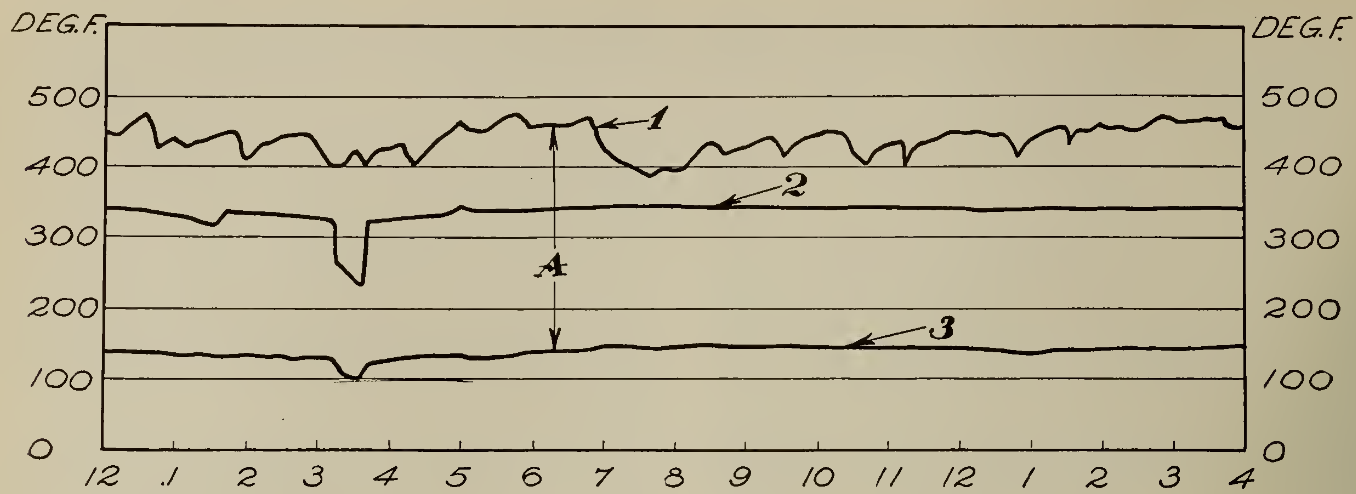


Figure No. 3.—Type of Wood Refuse Dryer.



A. Heat drop utilized in drying tower
1. Temperature of flue gases leaving boilers.
2. Temperature of gases entering tower.
3. Temperature of gases leaving tower.

Figure No. 4.—Temperature Diagram for Nordstrom Dryer in Operation.

plants consideration must be given to reducing still further the flue gas losses. This point is graphically illustrated in figure No. 1. A section through the boiler and furnace of a typical pulverized fuel fired plant is shown in figure No. 2, and illustrates modern practice in the industrial field.

Proceeding to the consideration of wood refuse burning, a situation is encountered which formerly was thought of as a problem of refuse disposal but which now is being considered as a problem in steam generation.

Wood refuse, in its different forms, has moisture contents varying from twenty to seventy-five per cent, depending upon the type of refuse and the conditions under which it is produced. Barking drum refuse usually contains some seventy-five per cent moisture if taken from a wet drum and some thirty-five to fifty per cent moisture if taken from a dry drum, depending upon how the logs are run and stored. At seventy-five per cent moisture content the average bark has an available heating value of 4,500 B.t.u. per pound of dry substance. At sixty per cent moisture content it has an available heating value of 6,200 B.t.u. per pound of dry substance, and at thirty per cent moisture content the heating value has been still further increased to 7,400 B.t.u. per pound of dry substance.

The efficiencies at which bark can be burned vary somewhat with the furnace conditions and vary a great deal with the moisture content of the bark. One well-known pulp and paper company states that at sixty-two per cent moisture content the efficiency of combustion is approximately fifty per cent, that at forty per cent the efficiency is approximately sixty per cent, and that at thirty per cent it is approximately sixty-five per cent. These efficiencies are operating figures and not test figures, and apply to an installation without economizers.

Results of tests in European mills give the following figures:—Efficiency of combustion at sixty-two per cent moisture content, fifty-six per cent; at forty per cent, sixty-nine per cent; and at thirty per cent, seventy-three per cent. These figures are test efficiencies and are also obtained without the use of economizers.

It is probable that the figures as given above are representative of results which will usually be obtained when burning bark. An exception might be made of the figure of fifty-six per cent as an operating efficiency for a boiler burning sixty-two per cent moist bark, as this is probably high.

At sixty-two per cent moisture content the theoretical combustion temperature of bark when burning alone and under test conditions is 1,400° F., this temperature being obtained by assuming perfect combustion and a CO_2 content of ten per cent. In actual operation, it is probable that the CO_2 would drop to a point not exceeding eight per cent, and, again assuming that combustion is complete, an eight per cent CO_2 content with sixty-two per cent moist bark would result in a theoretical combustion temperature of about 1,225° F. This latter temperature is very little higher than the ignition point of the volatiles which pass off from

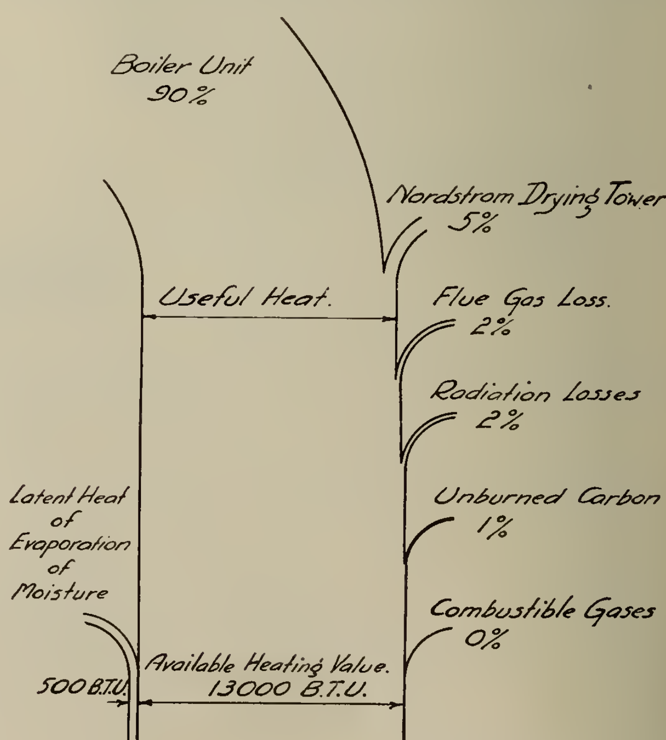


Figure No. 5.—Heat Distribution Diagram in a Modern Boiler Plant.

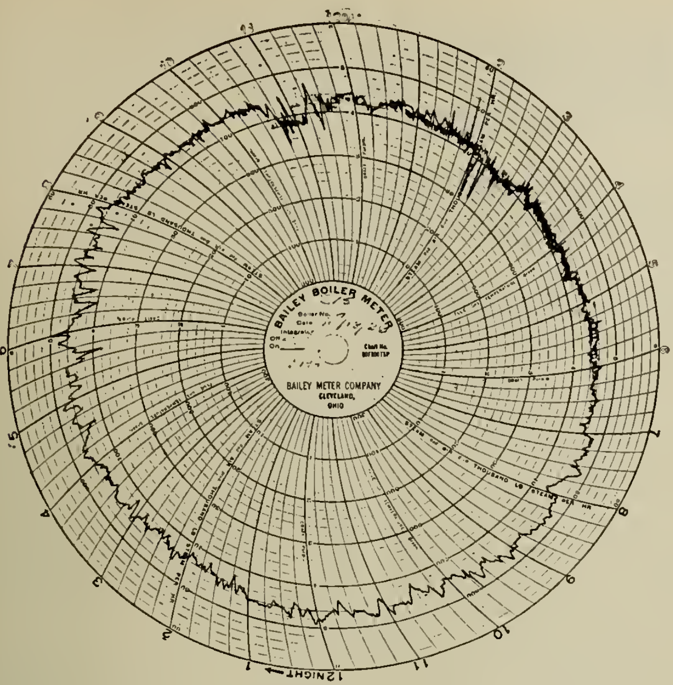


Figure No. 6.—Typical Boiler Meter Record of Plant with Steam Accumulator Installation.

the bark and which, depending on the fuel and on the method of firing, ignite at temperatures of from 1,000 to 1,200°.

With such a small difference between the actual combustion temperature of the bark and its ignition point, high efficiencies cannot be obtained, as a great deal of the volatile matter will not ignite at all. This condition is aggravated by the fact that the ratio of volatiles to fixed carbon in wood is frequently five to one and averages well over three to one in the fuel as fired. These volatiles begin to pass off at a temperature well below the ignition point of the fuel, and are frequently screened by water vapour during their passage through the furnace. The result is low efficiency.

If the problem of burning wood refuse is to be considered in its proper light as a problem in steam generation, means must be sought to improve the efficiency of combustion and to increase the obtainable boiler ratings which, with wet bark, are not high.

The most logical means of accomplishing this end apparently is to dry the bark, and many pulp and paper men in Canada at the present time are considering their wood refuse problem from that standpoint.

If our statements concerning pulverized coal plants be again referred to, it will be evident that there is a particular incentive for engineers to consider bark drying as a solution to their wood refuse problem. In order to dry the bark, heat is required. In the pulverized fuel boiler plant heat is wasted, and it is a peculiar fact that the greatest part of the heat wasted in the pulverized fuel plant, namely, the flue gas loss, is discharged from the boilers in exactly the correct form for most efficient bark drying. This fact has led to the development, for wood refuse and bark, of the waste heat dryer, which may be as important an advance, particularly in the pulp and paper industry, as has been the development of the economizer and air preheater.

Figure No. 3 illustrates a type of wood refuse dryer which recently has been attracting considerable attention. This particular dryer is built in the form of a tower consisting of a solid outer wall *G*, and two perforated inner towers *D* and *C*. The wood refuse is fed into this tower through a revolving chute *B* at the top and moves downwards slowly by gravity in the annular space between the two perforated sections. The dried refuse is discharged at the bottom of the tower, as shown, to a conveyor.

The cone *H* revolves and has attached to it scrapers which assist in discharging the refuse. The flue gas from the boiler house is drawn into a forced draft fan which delivers it under pressure to the inside of the perforated tower *C*. The gas then passes through the layer of bark as shown by the arrows and leaves the tower through a short stack. In case the flue gases from the boiler are too hot for the material to be dried, a circulating duct *S* is provided by means of which cool gas will be taken from the tower and mixed with the hot gases from the boiler house. The damper *T* in the duct *S* is controlled automatically for constant temperatures at the fan outlet.

The advantage of a drying tower of this type is that the drying medium at constant pressure comes into intimate contact with a layer of bark of uniform thickness and density. Figure No. 4 is a diagram of such a tower in operation.

A point to be noted here is that the heat given up by the flue gases from the pulverized fuel fired boiler house during the passage of these gases through the dryer is all usefully applied for what might be considered a process purpose and should not, therefore, be charged against the coal fired boiler house as a loss. If the flue gas is reduced from a temperature of 300 to 130° F., which, from an inspection of figure No. 4, apparently could readily be done, and if the heat abstracted from the gas be charged to drying, the actual flue gas loss will be reduced from seven per cent to about two per cent. Figure No. 5 has been prepared to show the revised heat distribution diagram for a plant in which the flue gas can be used for drying purposes.

It is recognized that in order to obtain results as shown in figure No. 5, there must be available sufficient wet refuse to require the use of all of the flue gases. Such a condition, of course, is not an uncommon occurrence in pulp and paper mills, particularly since flue gas temperatures have been much reduced. In fact, an instance has recently been brought to the attention of the writer in which the available quantity of flue gas from both the pulverized fuel fired boiler house and wood refuse fired boiler house, if reduced to about 130° F., would be exactly sufficient to dry all of the refuse to the required point.

Any attempt to combine two distinct and separately controlled effects, and from these effects to obtain a desired result, is always attended by certain difficulties, and in this case the difficulty seems to be that the boilers in average mills operate with a fluctuating output and hence with a fluctuating quantity of flue gas, while the wood refuse would probably be fed through the drying tower at a constant rate, and would consequently require a constant quantity of flue gas.

In certain cases, if uniform drying is not necessary, or if there is always an excess of flue gas, this lack of balance may not cause difficulty, but in other cases it might be a serious point. However, if mills with fluctuating steam demands have installed steam accumulators and through their use have steadied their boiler outputs, as shown on figure No. 6, any difficulty in respect to too great or too little momentary flue gas supply would be removed.

It is to be hoped that this article will not be considered as an attempt to cover completely a very large field. It was the writer's wish simply to comment on some existing tendencies which recently have come to his attention and possibly to attract discussion on a subject which refers to a problem not yet fully solved.

The New Aerodynamic Laboratory of the University of Toronto

A Description of the Laboratory with the Results of Air Flow Studies and Power Consumption Tests as Contained in Aeronautical Research Paper, No. 16.

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Associate Professor, Department of Mechanical Engineering, University of Toronto.

It is considered advisable, for several reasons, to present at this time a paper containing a brief description of the wind channel and equipment of the new aerodynamic laboratory of the University of Toronto. In the first place, the nature of the equipment of the laboratory should be known by those interested to assist in estimating the accuracy of the results of the investigations made and reported. Also, it has become customary to publish information relative to the characteristics of each wind channel, in order that comparison may be made with other channels and to permit of the results of tests being co-ordinated with similar results from other laboratories. A certain amount of information of this kind, pertaining to the Toronto laboratory, is contained in the present paper.

Further, the results of air flow studies and power consumption tests made at different periods during the construction of the new channel are considered to be of sufficient interest to justify their presentation in the form of a research paper. As this information, to be of maximum value, should be accompanied by complete descriptions of the channel, it is presented as an appendix to this paper.

Historical

In 1917 the Board of Governors of the University of Toronto authorized the installation of an aerodynamic laboratory in the Department of Mechanical Engineering and voted a special grant for its equipment. The laboratory was set up the following year in the hydraulic laboratory of the Mechanical Building. In 1923 conditions in the Mechanical Building became such as to force the removal of the channel. The Air Board of Canada, realizing the importance of such a laboratory to the development of aeronautics in Canada and the necessity of having available facilities for experimental and research work in aerodynamics for the government, offered a grant toward the erection of a suitable building to house the wind channel. The offer was made through the National Research Council, and was gratefully accepted by the university. The building was erected, equipment installed and the laboratory formally opened in February 1924.

The Original Channel

The original wind channel of the laboratory was of the N.P.L. type, 4 feet square at the working section with graded latticed distributor 6 feet 3½ inches by 6 feet 3½ inches by 20 feet 0 inches inside. Speeds as high as 48 f.p.s. were obtained with the 5 feet 6 inches diameter propeller chain driven from a 20 h.p. variable speed motor. Subsequently, a latticed intake was fitted to this channel, together with a second honeycomb at the entrance of the cone, and a new propeller enabling speeds of about 55 f.p.s. to be attained with improved steadiness and uniformity in the air stream. This channel and equipment are fully described in Aero Research Paper No. 1, September 1920.

The New Building and New Channel

The new building is of brick and steel construction, (see figure No. 1), with flat roof and concrete floor, and provided with ample window area. Its size, determined on a basis of that found satisfactory in an investigation conducted at the Royal Aircraft Establishment and described in R. & M. No. 574*, is 23 feet 3 inches by 60 feet 0 inches by 20 feet 3 inches high inside. The walls are smooth and the building free from obstructions other than those necessary to support the equipment.

Before erecting the channel in the new building, the question of the best type of channel to be used in order to obtain maximum range and efficiency was carefully considered, and, bearing in mind the relative merits of the different existing types of wind channel, together with the limitations imposed by local conditions, it was decided to use the R.A.E., (Royal Aircraft Establishment), type.

The R.A.E. channel is of the closed type with an experimental portion of square section and free return of the air. It differs from the N.P.L. type channel in that the short expanding cone, small diameter propeller and latticed distributor of box form are replaced by a long regenerative cone, large diameter propeller and cellular wall distributor. The channel has been described in a number of publications.**

The general arrangement of the new Toronto channel and building, as shown in figure No. 2, is very similar to that of the No. 2 7-foot channel of the Royal Aircraft Establishment. The channel is 44 feet 7 inches long overall, made up of the tube 4 feet square in cross-section and about 24 feet long, and the regenerative cone, roughly 20 feet long and 9 feet 10 inches in diameter, at the large end.

The latticed Toronto intake, (refer Aero Research

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* The model building there tested was 5.7 by 5.2 by 14.3 diameters, and the building housing the No. 2 7-foot channel at the R.A.E. is of these proportions.

** Note particularly R. & M.'s Nos. 574 and 847.

Figure No. 1.—Exterior View of New Aerodynamic Laboratory.

Paper No. 3, September 1920), which was developed and applied to the original channel to correct certain irregularities of air flow arising from the presence of obstructions in the building* was abandoned as unnecessary under the new conditions and a faired bellmouth entrance of usual form employed.

Construction of Channel

The 4 feet by 4 feet by 24 feet long tube of the original channel, with its steel framework and supports, was used in the new channel, with only minor alterations.

The design of the regenerative cone was based on that found so satisfactory in the model studies made at the R.A.E., to which reference has already been made. It was found in these tests that by the use of a suitable regenerative cone the power required to produce a given air speed could be reduced 33 per cent, as compared with that required with the usual short cone, without sacrificing either steadiness or uniformity of velocity distribution in the air stream.

In the cone there is a very easy transition in form and area of cross-section from the 4-foot square section of the tube to a circular section 9 feet 10 inches in diameter at the outlet or propeller end in a length of 19 feet 3 inches. This is accomplished by replacing the straight sides of the square section by circular arcs of progressively smaller and smaller radius until at about 8 feet from the outlet end the section becomes circular, of diameter slightly greater than the diagonal of the 4-foot square. The corners of the square tube are carried through straight in the cone for a distance of about 6 feet before beginning to flare out and merge into the circular.

The principal objection to cones of double curvature, such as the one described, is that of construction, which, with rigid materials, is troublesome and costly. This difficulty has been satisfactorily overcome at Toronto by using heavy canvas for the covering of the cone.

The construction of the cone will be apparent from figure No. 5. Nine transverse wooden frames, enclosing openings, corresponding to the different cross-sections of the cone, are supported at the level of the channel axis on horizontal beams carried on steel supports. The frames are tied together by numerous longitudinal strips of wood, the frames and strips together constituting a latticed form over which heavy canvas is stretched under great tension, and fastened with tape and tacks. The canvas is given several coats of cellulose acetate dope. To permit walking inside the cone, a narrow cat walk is planked along the bottom of the cone.

It was found that when the propeller rotated in this cone that the canvas vibrated somewhat between the wooden strips as the blades passed, and it was feared that this might result eventually in the canvas pulling away, consequently, the portion of the cone between the last two trans-

* The Toronto intake is used in the 4-foot N.P.L. channel of the Daniel Guggenheim School of Aeronautics, New York University, to correct similar troubles and "has proved extremely satisfactory." Aviation, May 1st, 1926, p. 293.

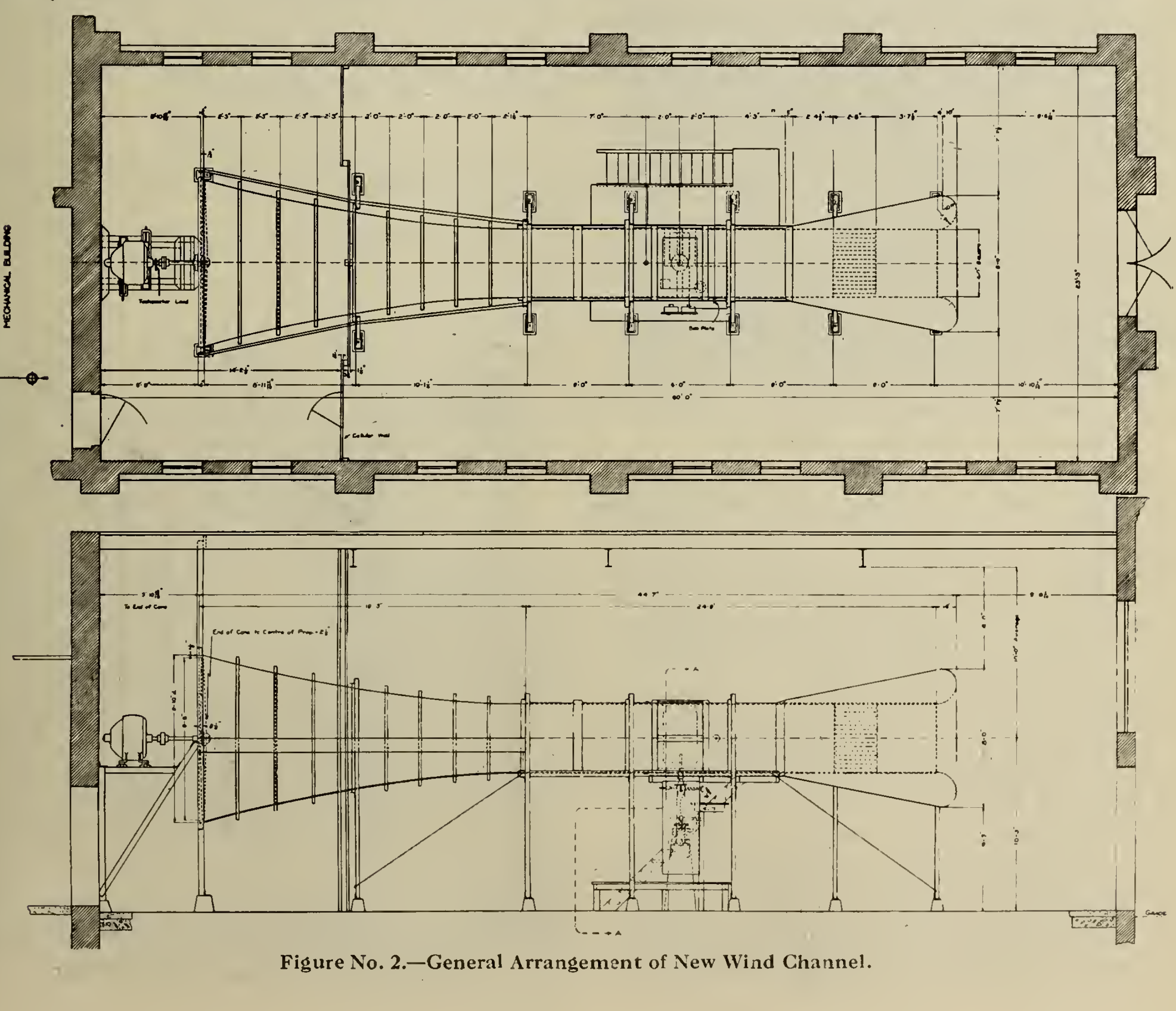

Figure No. 2.—General Arrangement of New Wind Channel.

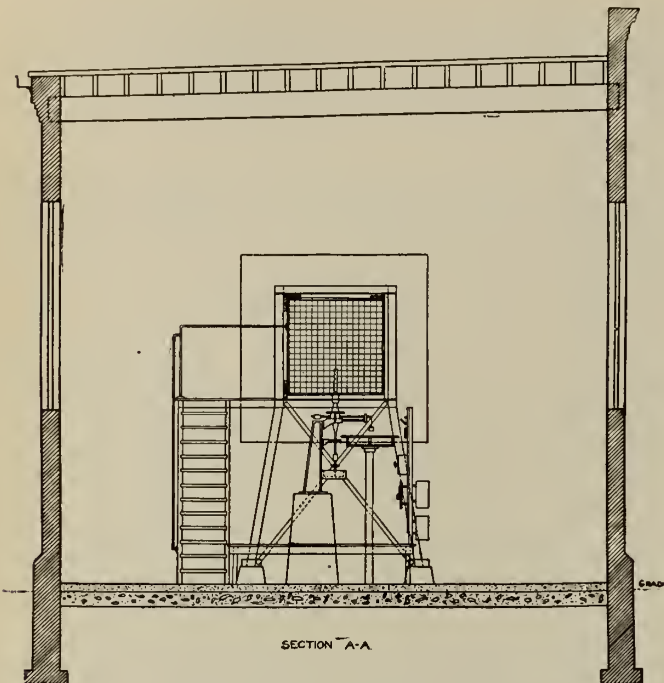

Figure No. 3.—Cross-section of New Laboratory and Wind Channel.

verse frames is sheeted with galvanized iron bolted to the strips.

This form of construction is relatively inexpensive and has proved most satisfactory in every way.

The construction of the intake is generally the same as that of the outlet cone, except that the original unfaired bellmouth, sheeted with wood, has been incorporated in the present faired intake. The whole is covered with doped canvas.

Subsequently, to prevent any possible infiltration of air through the wooden walls of the channel, the latter were also covered with canvas and the canvas doped.

A cellular honeycomb of sheet metal with 3-inch square cells 30 inches long, as used in the original channel, is placed about 42 inches from the entrance of the channel.

Longitudinal swaying of the channel is prevented by diagonal tie rods between the steel frames.

Position of Channel in Building

Care was taken in arranging the laboratory to place the channel as nearly in the centre of the building cross-section as possible, (see figure No. 3), in order to secure an even return flow of air through the building. The channel axis is equidistant from the side walls and practically midway between floor and roof, having regard to the presence of the roof beams. The centre line is 10 feet 3 inches above the floor, and an average of 10 feet below the slightly sloping 12-inch I-beams supporting the roof.

Placing the channel at this height necessitated setting the steel frames used in the original channel on 9-inch concrete pedestals. The intake end is 9 feet 6 inches from the end wall of the building, and the end of the regenerative cone practically 6 feet from the other end wall.

Operating Platforms and Support of Instruments

Due to the height at which the channel is placed, an elevated platform is built below the channel at the experimental section to enable the N.P.L. balance to be conveniently operated. Further, a small platform, reached by steps, is built at the level of the channel floor outside the door of the experimental section to render access to the interior of the channel convenient in setting up and adjusting models, and also to enable the roof balances, now being made, to be manipulated.

The N.P.L. balance is set on a heavy concrete pedestal and a small table is supported in a convenient position on an iron standard set in concrete to provide a rigid support for the manometers.

The platforms, stairs and table have all been built to offer a minimum resistance to the return flow of the air past them. (See figure No. 3.)

Cellular Wall Distributor

The cellular wall distributor is described in Appendix I to this paper.

Propeller and Drive

The propeller is four bladed, 9.5 feet in diameter by 2.75 feet pitch, and rotates 2½ inches from the outlet end of the cone. This leaves a clearance of 1½ inches between the tips of the blades and the metal sheeting of the propeller race. The tests at the R.A.E., already mentioned, and others at Langley Memorial Laboratory* showed it to be disadvantageous to place the propeller far from the end of the cone.

The propeller is direct connected to the same motor as was used in the original channel, an 18-20 h.p. variable speed shunt motor. The shaft, just back of the propeller, is carried in a ball thrust bearing. The motor and propeller are supported, quite independently of the channel, on a steel frame bolted to the end wall of the building and resting on a concrete pedestal. In this position the motor helps to deflect the air and is itself cooled.

Speed Control

The connections are arranged so that the motor can be run on either 110 or 220 volts, thus giving a wide speed

* N.A.C.A. Report No. 98.

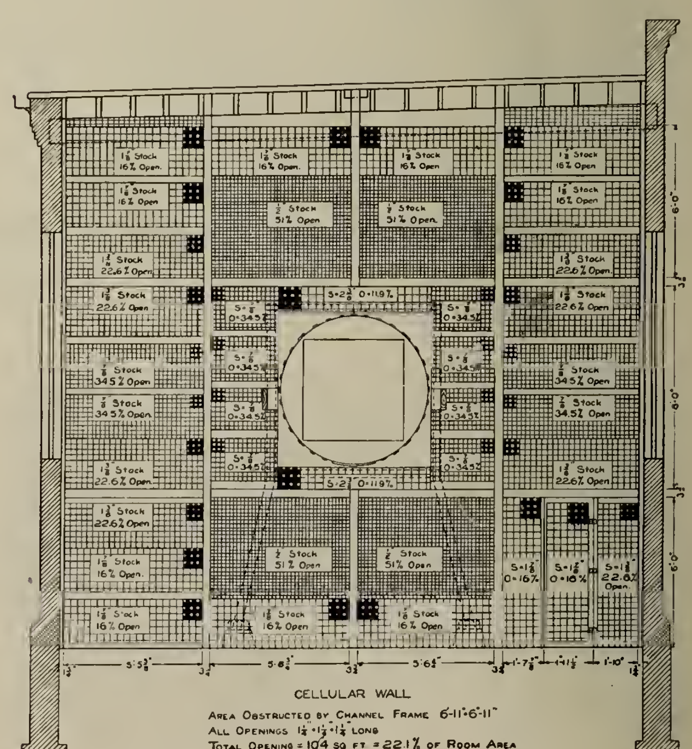

Figure No. 4.—Cellular Wall Distributor.

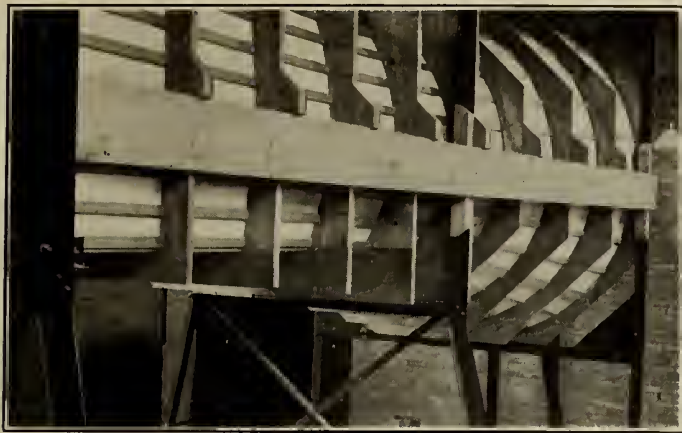

Figure No. 5.—View of Cone showing Features of Construction.

range. The speed range of the channel is from 15 to 88 f.p.s.

Speed is at present controlled manually, using a drum type controller on the armature circuit and coarse and fine rheostats in the field circuit.

There is now being installed in the Mechanical Building a constant voltage unit, controlled by a Tyrrell type regulator, which will deliver current at constant voltage to a special circuit. The wind channel motor will be connected to this circuit, rendering speed control in the channel much less troublesome.

Auxiliary Apparatus

Micromanometer

A Chattock tilting micromanometer* was used in the original channel, in conjunction with the side plate for indicating air speeds in the channel. This gauge possessed several distinctly valuable features, and while it was found generally satisfactory, it was open to two criticisms, namely, great fatigue and eyestrain in long continued use of the microscope and the excessive fragility of the glassware, necessitating extreme care in handling and manipulating the gauge. Further, with the increased speeds obtainable in the new channel, a gauge of greater range was required, since structural difficulties limit the range of tilting gauge to pressures of about one inch of water.

Mr. Douglas describes in R. & M. No. 657, 1919, a modified form of Chattock manometer developed at the R.A.E. which overcomes the disadvantages and limitations of the tilting gauge, while retaining its desirable features.

* See A.R.P. No. 2, p. 45 and figure No. 11.

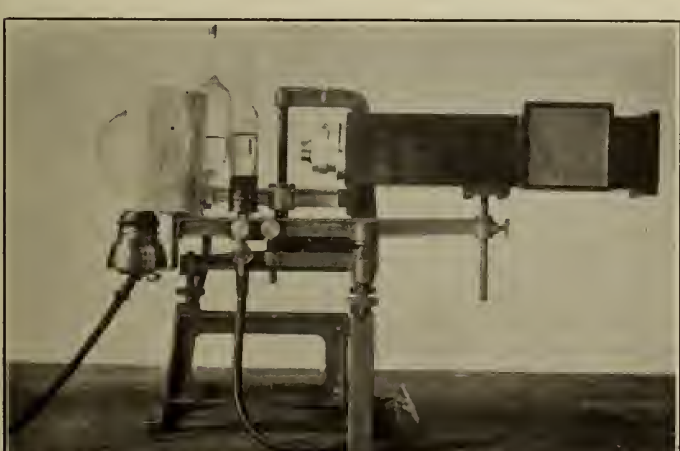

Figure No. 6.—View of Gauge Used at Toronto Laboratory.

In this gauge, instead of tilting the glass U-tube, one arm is raised to balance the pressure to the measured.

A gauge has been designed and several constructed at Toronto based on the R.A.E. design, but embodying certain features of sufficient interest to justify presenting a brief description of the gauge here.

The new gauge differs in three principal particulars from the Chattock tilting gauge, namely:—

1. The tilting principle is replaced by vertical movement.
2. The simplicity of the glassware.
3. The microscope is replaced by a projector.

The Toronto design, see figures Nos. 6 and 7, consists of a brass base carried on three levelling screws and fitted with a spirit level. Screwed to this base at one side is a C-frame carrying a micrometer screw and large diameter graduated micrometer disk. The micrometer screw rotates in cylindrical bearings, and the end play, which necessarily must be zero, is eliminated by holding the screw axially between two steel balls, the upper ball being pressed down by a flat steel spring, seen in the figures.

A large diameter glass bulb, forming one arm of the U-tube, is carried on an arm which may be raised or lowered by means of the micrometer screw, the amount of movement being shown by an indicating point registering on a graduated scale on the back of the C-frame, (see figure

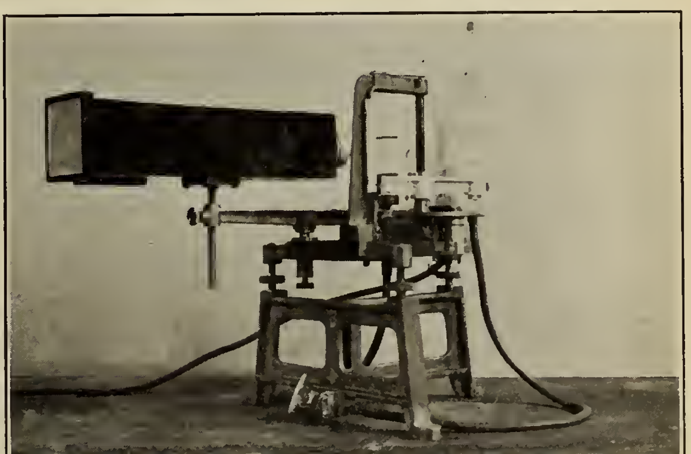

Figure No. 7.—View of Gauge Used at Toronto Laboratory.

No. 7), and by the micrometer disk graduated in thousandths of an inch.

At the other side of the base is a long arm which may be raised or lowered slightly by means of an adjusting screw. The arm carries the glass bubble tube, forming the other arm of the U-tube, and at either end a lamp and shield and an optical projector.

The bubble tube corresponds to the middle one of the three tubes of the tilting gauges and, as in the latter, consists of two concentric vertical glass tubes. The inner tube, of about 1/4 inch bore, is ground to a knife edge at the top and at the bottom connects through a long rubber tube and two stop cocks to the bulb on the elevating screw, thus completing the U-tube, which is filled with distilled water. The water rises to the knife edge of the inner tube, forming there a bubble or meniscus in the paraffin oil* with which the outer tube is filled.

First setting the micrometer head on zero and having filled the system, being careful to eliminate all air bubbles, the arm carrying the bubble tube is raised or lowered until

* Standard Oil Co., medicinal paraffin oil, "Nujol."

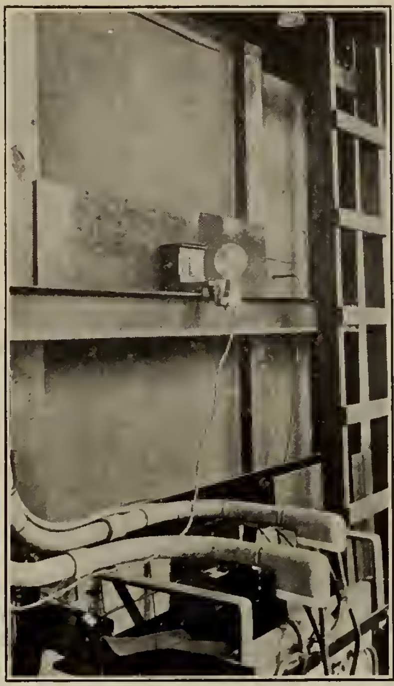

Figure No. 8.—Aligning Apparatus.

perpendicular to the air stream through a window in the the bubble rises to its position of maximum sensitivity. The lamp and optical system are then adjusted until a clear image of the bubble is thrown on the ground glass screens, the top of the image of the bubble being tangent to the cross hairs of the projector. Pressures may then be measured by raising the larger bulb by means of the screw until the pressure is just balanced by the applied pressure, as is shown by the bubble remaining tangent to the hair line. The pressure is then read, in inches of water, directly from the scale and micrometer head.

Provision is made in the gauge for vertical adjustment of the concentrated filament lamp, and also of the asbestos lined aluminum shield, in order to bring the light and aperture in the shield into the best positions for proper illumination of the bubble.

The image of the bubble is thrown on two ground glass screens at right angles to enable operators at both lift and drag arms of the balance to conveniently observe the air speed.

Of the two glass stop cocks provided, that forming part of the bubble tube safeguards the bubble when the gauge is being moved and is not ordinarily used, the other, con-

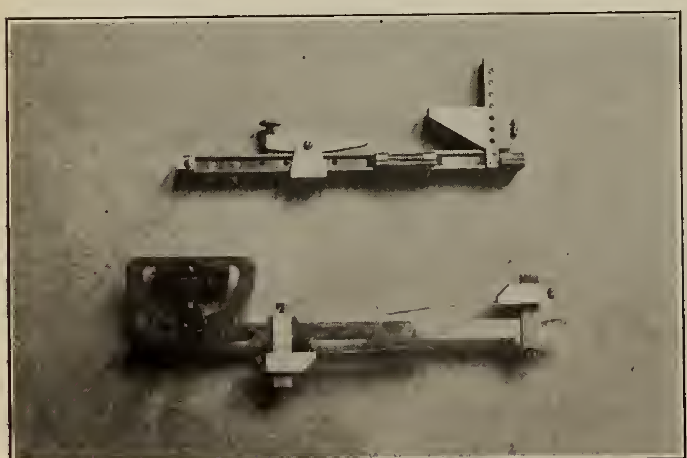

Figure No. 9.—Aligning Apparatus.

veniently clamped at the front of the stand, is used to close the gauge in ordinary routine operation.

The stand is employed to raise the gauge so that the rubber tubing may hang more or less freely and not change its shape appreciably for different elevations of the movable bulb. Two of the seats in which the three levelling screws of the base rest are in the form of V-grooves, at right angles, the third being a conical seat. This enables variations in centre distance between the screws to be accommodated while at the same time preventing the gauge from slipping off the stand.

The advantages of this gauge are:—

1. Its great sensitivity. The gauge will indicate a change of pressure of 0.0001 inch of water.
2. Its great range. The gauge shown has a range of 3 inches of water, but gauges of this type can be readily made with greater ranges.
3. Simplicity of the glassware.
4. Convenience of observation and absence of eyestrain.
5. Extreme accuracy in making the gauge is confined to the two parts, the screw and nut. The accuracy of the gauge depends solely on the accuracy of these parts.

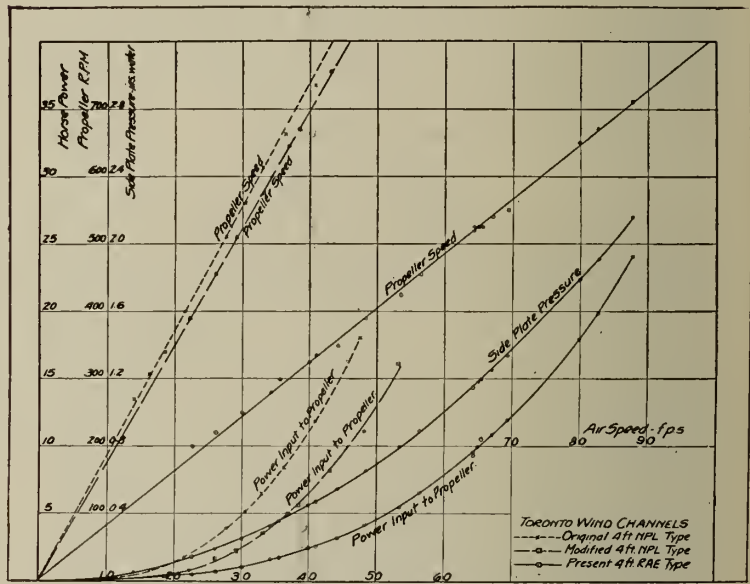

Figure No. 10.—Aerodynamic Characteristics of the Toronto Wind Channels.

6. The gauge is an absolute standard. No calibration is necessary, provided the screw is accurate.

Gauges of this design have been used at Toronto in routine operation of the channel for some three years, and have proved most satisfactory. After a long continued run, on returning the gauge to zero the check is invariably perfect.

Aligning Apparatus

In aligning the chords of aerofoils parallel to the air stream, in the horizontal plane, *i.e.*, when testing aerofoils in the usual manner on an end spindle, an optical alignment device of great sensitivity and convenience is employed, replacing the apparatus previously used and described in Aero Research Paper No. 1. The device is similar to that employed in the atmospheric channel at the Langley Memorial Laboratory, as described in N.A.C.A. Technical Note No. 35, 1921, but with certain modifications rendered necessary in applying it to the R.A.E. type channel.

The apparatus consists of two main elements, (see figure No. 8), a projector, throwing a narrow beam of light

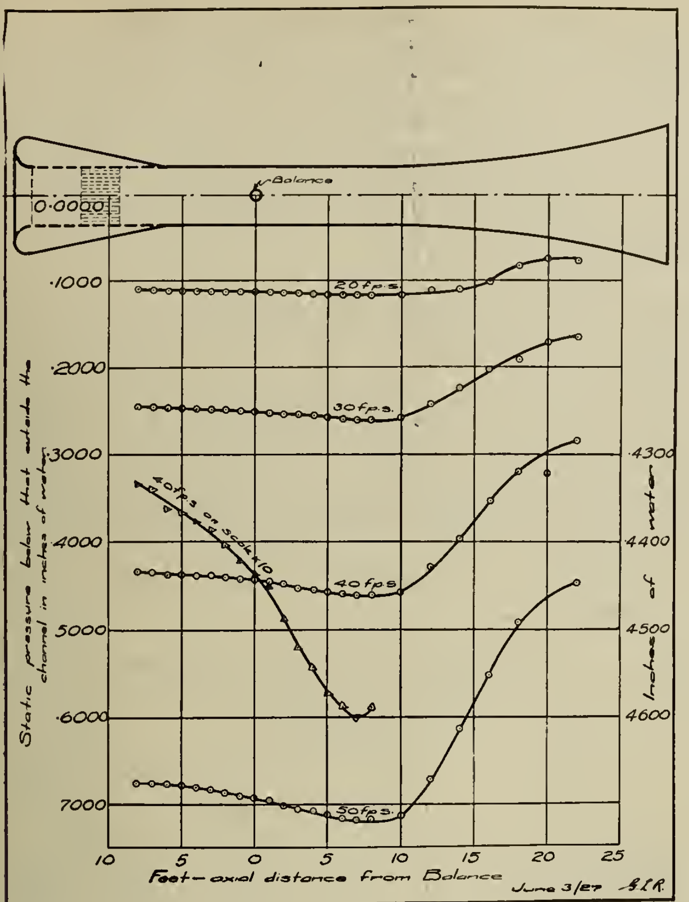

Figure No. 11.—Static Pressure Gradient—4′ x 4′ R.A.E.

channel wall, and a mirror clamped to the aerofoil, (see upper instrument in figure No. 9), which reflects the beam of light back on a target carried by the projector. The aerofoil is adjusted until the reflected beam registers on a point on the target directly above the aperture through which the beam passed from the projector. The aerofoil chord is then parallel to the air stream.

The lens, slit, lamp and target comprising the projector are carried on a frame, arranged to have a transverse motion on a base, which in turn slides on ways machined on the upper flange of a horizontal I-beam, bolted to two of the steel frames of the channel. This permits the projector to be brought up quite close to the glass of the window and to be moved along the channel to accommodate different sizes and positions of aerofoil. The projector is at the level of the centre of the channel. Both slit and lamp carrier are adjustable for focusing purposes, and the 100-watt concentrated filament lamp is enclosed in a casing, not shown in the figure. The vertical target plate is carried in front of the lens, and as close to the glass of the window as possible. There is a narrow vertical slot in the target plate through which the beam of light is projected, and directly above the slot a small hole. The latter is illuminated by the beam of light, rendering it visible, through a window in the channel floor, to the operator at the balance.

The mirror may be turned about a spindle fitted to a light steel straight edge. The latter is arranged with a spirit level and clamp, by means of which it may be attached to the aerofoil, tangent to the chord, and horizontal.

In aligning an aerofoil, the procedure is as follows:—The spindle carrying the aerofoil is first gripped in the chuck of the balance in approximate alignment, and the straight edge carrying the mirror clamped to the aerofoil and levelled.

The projector is moved along the ways until the beam of light strikes the mirror. The latter is adjusted on its spindle to return the beam to the target at the proper level. The vertical arm of the balance is then rotated until the reflected beam strikes the target, bisecting the small illuminated hole. The operation of aligning an aerofoil may thus be carried out by a single operator. The device is initially calibrated by testing an aerofoil in the usual way in normal and reversed positions for lift and drag.

The device is exceedingly convenient and accurate. The reflected beam can be easily located on the target to within 1/64 inch which, on a length of 48 inches means that the aerofoil can be lined up to within one minute of the desired direction.

For aligning complete models or aerofoils in normal flight position, the lower instrument in figure No. 9 has been found very convenient. This instrument is a level, consisting of a light steel straight edge, provided with adjustable spring clamps, and to which is fastened at one end a protractor. The vernier indicator of the protractor, fitted with a lens, is attached to a spirit level. The desired angle of incidence is set accurately on the protractor, with the aid of the vernier and lens, and the instrument attached to the model with the straight edge tangent to the chord. The model is then adjusted until the spirit level is level. The straight edge, and therefore the chord, are then at the required angle to the horizontal.

Aerodynamic Balance

The balance of the channel is of the N.P.L. type and has been fully described elsewhere. In addition to the improvements incorporated in the balance as originally made, described in Aero Research Paper No. 1, additions have since been made to the balance to improve its range and convenience of operation.

1. The weight arms have been fitted with steel tie rods to limit deflection under the greater weights to be carried at the higher air speeds possible in the new channel.

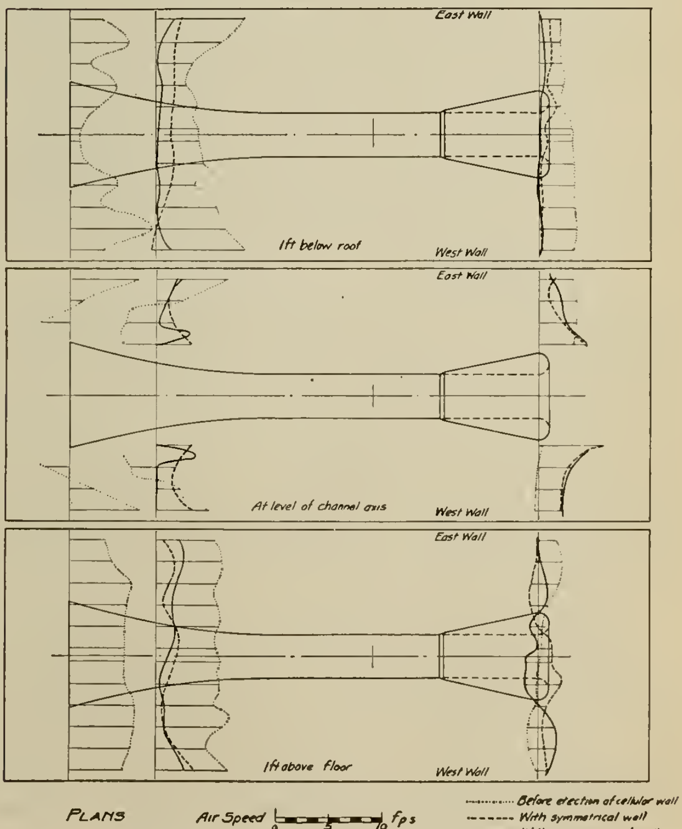

Figure No. 12.—Air Speeds in Building.

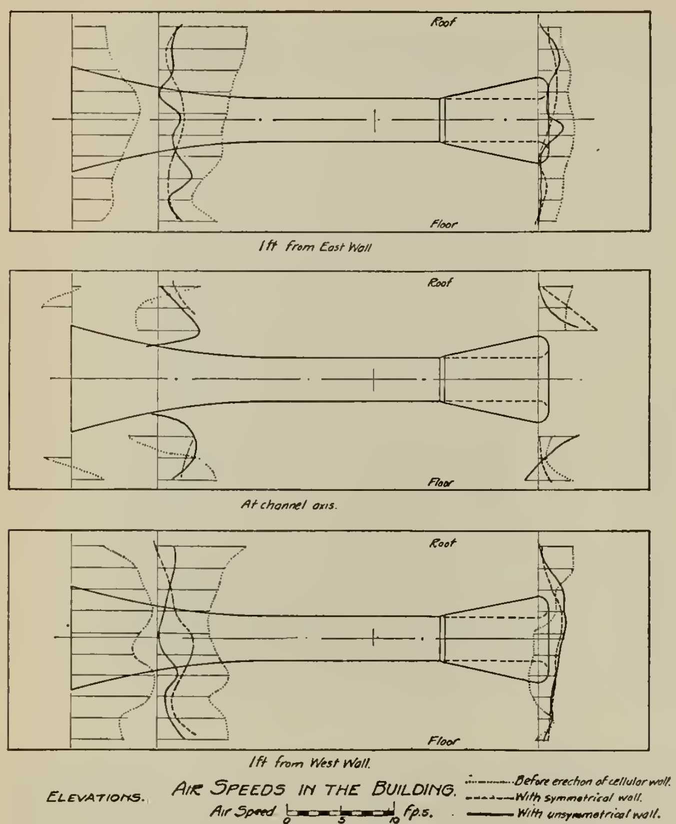

Figure No. 13.—Air Speeds in Building.

2. The vertical arm of the balance has been fitted with a large gear and pinion to enable settings of incidence to be more easily made.
3. A small microscope permits the protractor to be read with greater precision.
4. A turntable has been inserted in the channel floor surrounding the vertical arm of the balance to enable biplane and similar tests to be conveniently made. The under side of the turntable is graduated in degrees and provided with a vernier to enable accurate settings of angle being made. A series of holes, arranged in a spiral, are tapped into the turntable to take a standard fitted with a chuck for holding a second spindle supporting an aerofoil or other model.

At the present time there are under construction two roof balances for the channel patterned after those used in the British 7 by 14 channel. These balances are to be carried on steel beams above the channel. The forward balance is arranged for measuring lift and rolling movements, while the rear balance will measure lifts and drags. The two will thus enable complete determinations of lift, drag, centre of pressure, pitching and rolling moments to be made, with one setting of the model, and yawing moments with a second setting. An advantage of the balances will be the absence of any wires or other obstructions upstream from the models.

Aerodynamic Characteristics of the Channel

The aerodynamic characteristics of the present Toronto channel are plotted on figure No. 10. Input power to the propeller and propeller speed are plotted on average speed over the central 30-inch square of the channel cross-section. The maximum observed speed was 87.8 f.p.s., practically one mile per minute, at a propeller speed of 710 r.p.m. and a power input of 24.03 horse power. Side plate pressures are also plotted on this diagram.

For purposes of comparison, the characteristics of the original N.P.L. type channel at Toronto, under two sets of conditions, have also been plotted on figure No. 10. In one case the channel was equipped with a simple bellmouth intake, honeycomb and four bladed propeller, chain driven, of 5 feet 6 inches diameter and 3 feet pitch; in the other case, the channel was fitted with the Toronto intake, and a more efficient propeller of N.P.L. design, 5 feet 6 inches diameter and 2 feet 3 inches pitch, (see figure No. 1*a* Aero Research Paper No. 1).

A comparison of these curves is instructive. The very high power consumption of the original channel in the first case was due principally to two causes, namely, large exit losses due to high velocity at exit from the cone and an inefficient propeller. In the second case, while the addition of the latticed intake increased the power consumption slightly, this was more than offset by the greater efficiency of the new propeller. The very large saving in power effected by the new design of channel employing the regenerative cone and large diameter propeller is well indicated by the power curves.

A further comparison of the channels is afforded in the following table:—

Comparison of Toronto Channels

Channel	Propeller (All propellers have four blades)		$\frac{V}{ND}$	Power Factor
	Diameter	Pitch		
Original N.P.L. type....	5.5	3.00	.00984	10.83
Original N.P.L. type with Toronto intake........	5.5	2.25	.01042	6.50
Present R.A.E. type.....	9.5	2.75	.01298	2.19

In brief, the original channel used five times and as modified used three times the power of the present channel for the same air speed.

The variation of static pressure along the channel axis at different air speeds is shown on figure No. 11. The pressures were determined from pressure differences between the static pressure openings of a standard Pitot tube and the side plate of the channel measured on the micromanometer previously described in this paper.

Appendix I—Cellular Wall

It was anticipated that placing the channel in the centre of the building cross-section would result in an evenly distributed flow of air in the building and consequently a uniform distribution of velocity in the channel. However, velocity traverses made in the channel, (see *A* figure, No. 15), disclosed the fact that the variation of velocity in the channel was excessive. In an effort to determine the cause of the variation, an extensive study of the air flow in the building was made, using fine silk threads and smoke, the results of which are shown in figure No. 14. It will be seen that the flow had a decided rotary motion imparted to it by the propeller, that there was much eddying in the building and that the platforms and apparatus under the channel displaced the air currents to a considerable extent. The bulk of the air entered the bellmouth at the top and east side, resulting in the uneven distribution of velocity found in the channel.

A further study of the rate of the return flow, using vane anemometers, confirmed the results of the smoke in-

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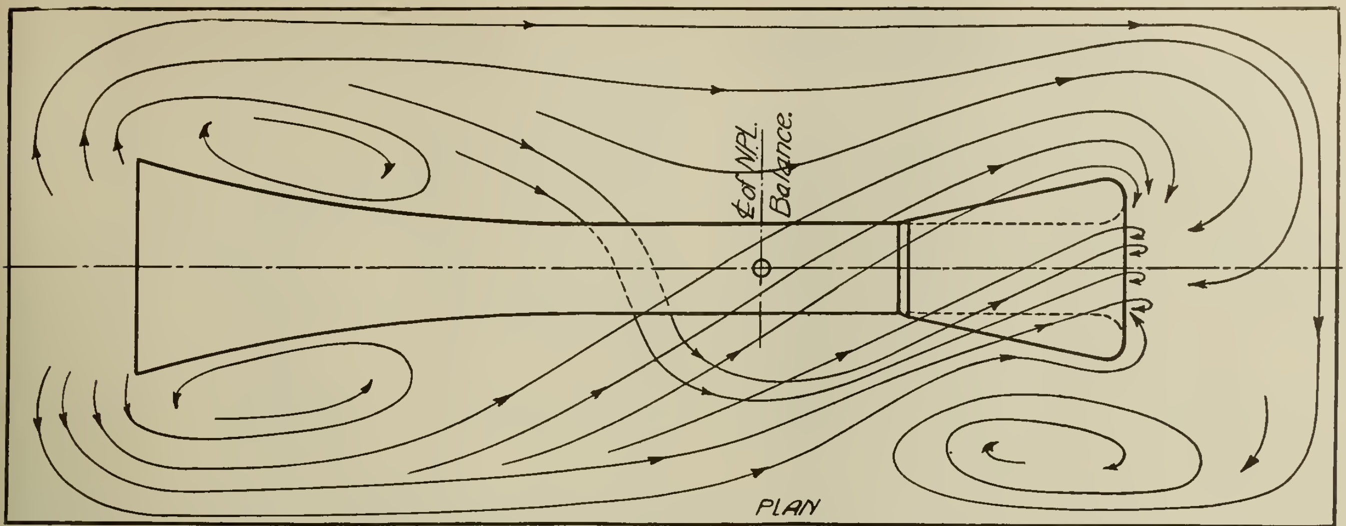
* Propeller speeds were read on an aircraft tachometer ordinarily used to roughly indicate the propeller speeds. Precise readings were not possible with this instrument, and the plotted points are consequently in some cases rather far from the line.



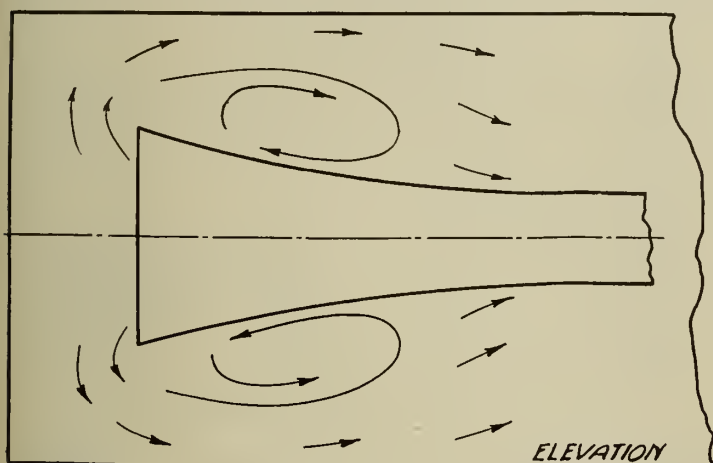


Figure No. 14.—General Air Flow in the Building Before Erection of Cellular Wall. (Percentage Variation from Mean.)

vestigation and showed, (see figures Nos. 12 and 13), that the highest velocity of flow was along the boundaries of the building cross-section, walls, roof and floor, and that very little return flow took place in the neighbourhood of the channel.

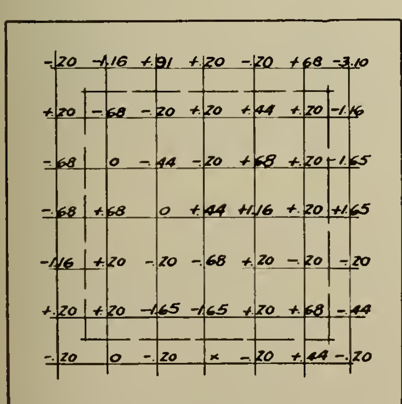
In tests with models made at the Royal Aircraft Establishment, and described in R. & M. 574, December 1918, it was found that placing a cellular wall across the wind channel building improved considerably the distribution and steadiness of flow in the channel, particularly in a small building. It was further found that the ratio of hole area to total wall area should be about one-third, and that the best position of the wall is from one-half to one propeller diameter from the large end of the cone.

Hence, to correct the previously mentioned defects in the air flow, both within and without the channel, a cellular wall was erected across the building, (see figure No. 14). The wall was placed 8 feet 3 inches from the outlet end of the cone. This position conformed to the recommendation quoted in the foregoing, and was also convenient due to one of the steel supporting frames being located at this section.

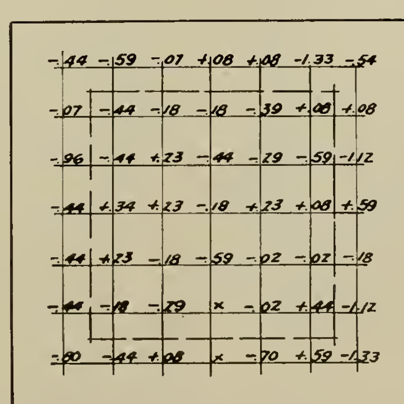
The wall was composed of the latticed gratings used in the distributor of the original N.P.L. type channel, (see Aero Research Paper No. 1)), the area of the wall being only slightly less than the total area of the distributor. The gratings are made with openings 1¼ inch square and 1¼ inch long, to have a directive effect on the air flow, and the various gratings have different percentages, varying from 12 to 51 per cent of the whole area occupied by the openings. The total area of the openings in all of the gratings composing the wall is 22 per cent of the cross-sectional area of the building.

As will be seen in figure No. 14, in arranging the wall an effort was made to secure uniform distribution of return flow throughout the building by placing the gratings with minimum open area around the boundaries of the building cross-section and those with maximum hole area next the channel. The arrangement of the gratings in the wall was, as far as possible, symmetrical about the channel.

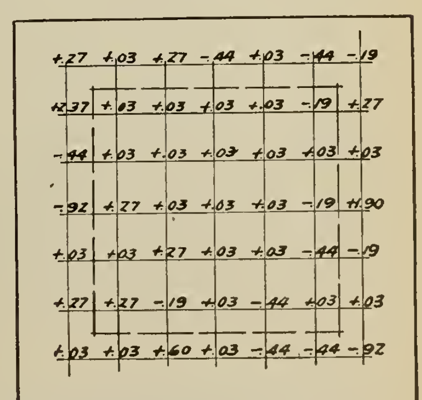
The distribution of velocity in the channel still proved unsatisfactory, (see *B* figure No. 15), and a further anemometer investigation of the flow through the wall and around



A Before erection of cellular wall.



B. With symmetrical wall.



C. With unsymmetrical wall.

Figure No. 15.—Velocity Distribution in the Wind Channel.

the intake showed, (see figures Nos. 12 and 13), that most of the return flow was taking place along the west side of the building, the flow along the east side, particularly near the floor, being quite small.

Consequently, the hole area on the west side of the wall was somewhat reduced and that on the east side, and especially near the floor, was increased. Further, as apparently the presence of the platforms, pedestals, instruments, etc., below the channel seriously restricted the flow below the channel, in an attempt to establish more symmetrical flow, a slotted grating 6 feet 6 inches square, with a slot area equal to about 50 per cent of the whole area, was placed above the channel between roof of building and top of channel at the working section.* These changes effected a fairly uniform distribution of return flow of air into the bellmouth, (see figures Nos. 12 and 13), and the resulting distribution of velocity over the working part of the channel proved to be satisfactory. (See *C* figure No. 15.)

It was found, from power measurements made and described in Appendix II, that the presence of the cellular wall actually reduced slightly the power necessary to produce a given air speed in the channel, apparently due to the elimination of power loss in eddys in the building.

Appendix II—Power Consumption Tests

At various stages during the erection of the channel, power consumption tests were made on the channel. The power input to the motor was measured and the accurately determined losses in the motor deducted to yield the power input to the propeller. Velocity traverses were made at the experimental section of the channel with a standard Pitot tube, (see Aero Research Paper No. 2, figure No. 8, right hand tube), and a slanting of Krell manometer, (described in the same paper, p. 43 and figure No. 9), readings being taken every 6 inches, and in many of the latter tests every 3 inches. The reference velocity was held constant by means of a side plate and Chattock manometer, later a modified Chattock manometer, as described in the foregoing paper. From the traverses the average velocity over the central or working part of the air stream 30 by 30 inches was determined.

In all, tests were made under seven sets of conditions, as follows:—

Test A—Bare channel, without honeycomb or cellular wall and with canvas untreated.

Test B—Canvas of the regenerative cone treated with five coats of cellulose acetate dope.

Test C—Canvas of the regenerative cone treated with six coats of dope, that of intake with one coat of dope.

Test D—Honeycomb built in the channel.

Test E—Propeller race sheeted with galvanized iron.

Test F—Cellular wall erected.

Test G—Channel tube covered with canvas and latter doped.

The results of these tests are tabulated in table No. 3 and plotted on logarithmic axes on figure No. 16.

The graphs show clearly the effects of the different changes made in the channel during its erection. Doping the canvas reduces appreciably the power necessary to produce a given air speed. The introduction of the honeycomb, as would be expected, greatly increases the power, while each of the subsequent changes, namely, sheeting the propeller race, covering the tube with canvas and erecting the

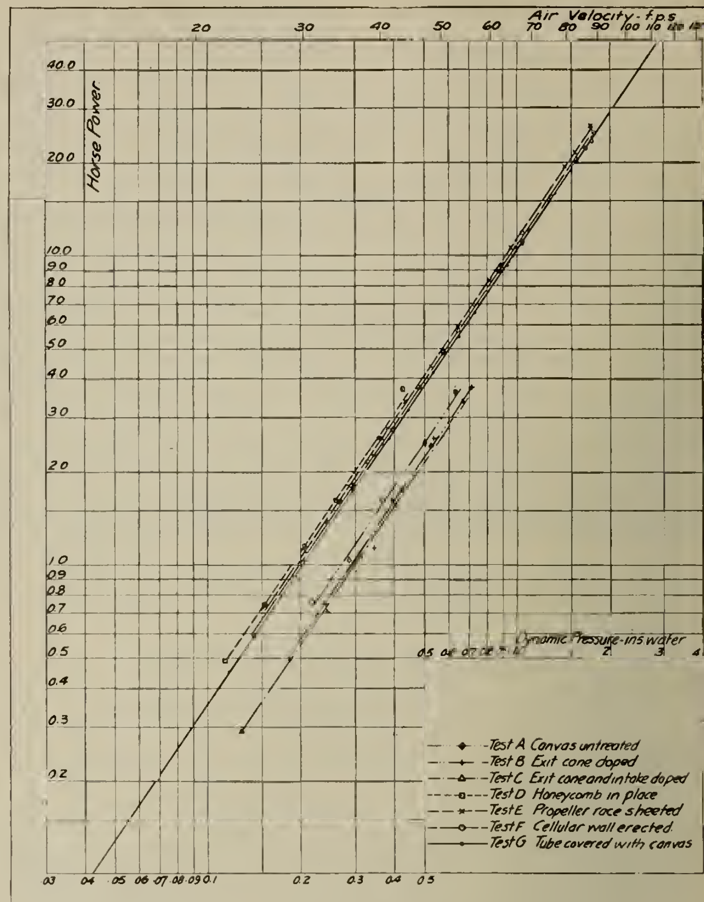


Figure No. 16.—Channel Power Consumption.

cellular wall results in slight, though definite, reduction in power.

The reduction in power effected by preventing infiltration of air through the channel walls agrees with similar results secured with the No. 2 7-foot R.A.E. channel. (See R. & M. 847, 1922, p. 4.) That the cellular wall would reduce the expenditure of power necessary for a given air speed in the channel was rather unexpected, but apparently the increased resistance to flow at the low air speeds is more than offset by the reduction in the power lost in eddys in the building.

Theoretically, the power required for a wind channel varies as the cube of the air speed. The slope of the lines on figure No. 16 is 1.473, *i.e.*, the power varies as the 1.473 power of the dynamic, or impact, pressure, or as the 2.946 power of the velocity.

In the case of the experiments at the R.A.E. on model channels, the "power factor" is used as a means of comparing the consumption of power of different channels where the power factor is the input power to the propeller to produce a velocity of 100 f.p.s. over one square foot of working section of the channel, *i.e.*,

$$\text{power factor} = \frac{AV^3}{\textit{input horse power}} 10^{-6}.$$

By extrapolation, on figure No. 16 the power to produce 100 f.p.s. air velocity in the Toronto channel would be 35 h.p., corresponding to a power factor of 2.19. The best arrangement of model, propeller, etc., in the R.A.E. tests yielded a factor of 1.9, and the factor for the No. 2 7-foot R.A.E. channel, of which the design was based on the model tests, was 1.9.

* Compare with R. & M. 847, 1922, in which it is stated that with the No. 2 7-foot channel at the R.A.E. it was found necessary to blank off 100 square feet of area of wall above the channel.

Table No. 1:—Power Consumption Tests—Original 4-Foot N.P.L. Type Wind Channel

Power to Propeller		Propeller Speed	Air Speed f.p.s.
Watts	Horse Power		
505	0.677	270	14.0
550	0.737	307	16.2
1084	1.450	372	19.6
1292	1.732	400	21.5
2235	3.000	473	25.4
2932	3.925	510	27.6
3810	5.11	560	30.4
4845	6.49	613	32.9
6250	8.38	663	36.3
8822	11.83	735	40.9
12042	16.16	815	46.1
13500	18.10	843	47.5

Table No. 2:—Power Consumption Tests—Modified 4-Foot N.P.L. Type Wind Channel

(Toronto Intake and N.P.L. Propeller)

Power to Propeller		Propeller Speed	Air Speed f.p.s.
Watts	Horse Power		
219	0.294	340	18.5
579	0.776	390	22.2
1223	1.641	455	26.0
1666	2.232	510	29.1
2671	3.578	575	33.2
3720	4.985	645	36.9
4197	5.63	670	38.4
6110	8.19	755	43.1
8275	11.09	825	48.1
11980	16.09	905	53.1

Table No. 3:—Power Consumption Tests—Toronto 4-Foot R.A.E. Type Wind Channel

Power to Propeller		Propeller Speed	Velocity Head Inches Water	Air Speed f.p.s.
Watts	Horse Power			
Test A—Bare channel.				
567	0.76	205	0.216	30.78
777	1.04	270	0.287	35.45
1203	1.61	300	0.369	40.20
1849	2.48	340	0.501	46.90
2677	3.59	390	0.631	52.60
Test B—Canvas of regenerative cone doped (5 coats).				
366	0.491	204	0.185	28.48
554	0.744	225	0.240	32.45
844	1.132	260	0.347	39.00
1202	1.61	295	0.396	41.65
1901	2.55	340	0.537	48.50
2773	3.72	390	0.707	55.60
Test C—Canvas doped—Exit cone 6 coats, Intake 1 coat.				
216	0.289	175	0.129	23.78
527	0.707	225	0.241	32.5
791	1.06	260	0.318	37.3
1165	1.00	295	0.408	42.3
1299	1.74	305	0.427	43.3
1809	2.43	340	0.527	48.1
2507	3.36	375	0.664	54.0

Table No. 3—*continued*

Power to Propeller		Propeller Speed	Velocity Head Inches Water	Air Speed f.p.s.
Watts	Horse Power			
Test D—Honeycomb built in.				
361	0.484	208	0.115	22.42
549	0.736	230	0.153	25.90
847	1.135	263	0.201	29.75
1204	1.610	295	0.259	33.70
1345	1.805	305	0.295	35.95
1908	2.560	335	0.359	39.70
1863	2.495	335	0.365	40.00
2736	3.670	380	0.475	45.70
Test E—Propeller race sheeted.				
547	0.734	225	0.153	25.9
832	1.116	260	0.206	30.0
1197	1.605	290	0.268	34.25
1333	1.790	305	0.288	35.45
1894	2.540	330	0.365	40.00
2054	2.752	345	0.378	40.65
2508	3.365	365	0.437	43.8
3279	4.390	440	0.528	48.1
4259	5.725	450	0.650	53.4
5165	6.920	475	0.717	56.0
6170	8.275	500	0.812	59.6
6885	9.24	525	0.886	62.3
7795	10.44	545	0.950	64.5
14302	19.20	655	1.420	78.8
15763	21.13	700	1.528	81.8
19010	25.50	735	1.740	87.2
19330	25.90	750	1.735	87.1
Test F—Cellular wall erected.				
441	0.590	215	0.141	24.85
682	0.913	250	0.191	28.90
1023	1.370	275	0.242	32.55
1189	1.591	285	0.269	34.30
1603	2.150	320	0.328	37.85
1697	2.275	325	0.342	38.7
2038	2.725	335	0.391	41.4
2781	3.730	375	0.482	45.9
3626	4.865	400	0.578	50.3
4278	5.73	440	0.641	53.0
6625	8.89	500	0.874	61.9
8205	11.00	550	1.028	67.1
8860	11.88	550	1.025	67.0
11475	15.39	620	1.289	75.0
15197	20.19	675	1.546	82.2
16435	22.05	700	1.673	85.5
17385	23.3	700	1.736	87.1
17385	23.3	700	1.746	87.4
18460	24.9	710	1.785	88.0
18460	24.9	710	1.772	88.0
Test G—Channel tube covered with doped canvas.				
336	0.450	200	0.118	22.7
463	0.621	220	0.156	26.1
770	1.032	250	0.205	30.0
1147	1.537	280	0.268	34.3
1295	1.737	300	0.292	35.7
1849	2.476	325	0.366	40.0
1897	2.545	335	0.385	41.0
2370	3.177	350	0.447	44.2
3116	4.178	390	0.535	48.4
4064	5.450	425	0.652	53.5
4878	6.540	455	0.729	56.4
6940	9.310	520	0.942	64.3
7150	9.580	525	0.942	64.3
7405	9.925	525	0.967	65.0
7855	10.530	525	0.981	65.5
8062	10.810	540	1.028	67.1
8931	11.960	550	1.096	69.3
13382	17.920	650	1.459	79.9
14791	19.810	670	1.564	82.7
17923	24.030	710	1.764	87.8

Discussion of Paper on Hydro-Electric Developments on the Gatineau River, by J. A. McCrory, M.E.I.C.*

Mr. T. C. Thompson, J.E.I.C.

Mr. Thompson desired to draw attention to a particular incidental problem, that of inductive interference, which had presented itself to the Bell Telephone Company when it was decided to build an emergency 33,000-volt transmission line from Chelsea to Paugan Falls which would parallel long distance communication circuits for some seventeen miles. The Gatineau Power Company had been able to co-operate with the communication company to such an extent before the completion of the line that satisfactory results had been attained.

Ordinary problems of inductive interference were, of course, a common occurrence, encountered in almost all new pole line construction to-day, but with this particular case were associated some interesting details.

With an exposure of about 90,000 feet, and on the assumption of a load of 5,000 h.p., (double the estimated minimum), the calculated induction without precautionary measures was about seven times the allowable limit, provided the wave shape in the transmission line was not distorted in excess of the limit mentioned in the generator specifications. If this limit were exceeded, then the induction would be proportionately greater. This calculation showed that a design of co-ordinated remedial measures of a high standard was imperative.

The route of the power line followed a narrow and winding road also used by telephone companies. The close proximity of the power and telephone lines, with the unavoidable variation in many places from a uniform separation on account of the winding road, required most careful design to prevent the telephone circuits from becoming commercially inoperative on the energization of the power line.

To maintain as great a uniformity in separation as possible required the movement of certain individual power poles. Also, for about a mile the existing location of the telephone line and the proposed location of the power line were interchanged to facilitate the design. In passing, he would like to mention that it was due to the courtesy of the power company, in acceding to these requests of the communication company before the completion of the line, that a satisfactory design could be effected.

The computed result of this design showed a reduction in electromagnetic induction from 8,000 to 35 millivolts. However, they did not expect to realize such a large reduction, because of practical discrepancies from the theoretical assumption; as, for example, a small variation in the actual location of transpositions from the theoretical and the probable presence of some residual effects in the power line.

Results showed that for electrostatic induction the design was most effective, and it was not being too optimistic to hope for equal success for the electromagnetic case. This, however, could not yet be proved, as at present there was no means of measuring the load on the power line.

* This paper was presented at the Annual General Professional Meeting of The Institute, Quebec, February 17th, 1927, and was published in the Engineering Journal, March, 1927.

Discussion of Paper on The Wood Consuming Industries of Canada, by John Stadler, M.E.I.C.**

The Hon. H. Mercier.

The Hon. Mr. Mercier wished to say a few words on the questions of the exportation of pulpwood, and building new pulp mills in the province, because these policies had been referred to as being put forward by the government, and he would like to express his own personal sentiments on the subject. In saying " exportation " he meant exportation to the United States. It was the desire of some people to stop exportation of pulpwood, for instance, from Quebec to the other provinces. They might be right, but so far as he was concerned he was unable to agree with them. He did not believe in building barriers between the different provinces of Canada. In dealing with questions of an economic character it should always be remembered that we are living not on a small area, but on a very large area which is called Canada, and that all our efforts must be directed to further the interests of the whole country rather than the interests of any one province.

In reference to exportation to the United States, he believed that everyone would favour any move to prevent exportation of our raw materials to the United States, and would prefer to see that raw material converted into products here on our own territory,—the only fair method after all,—but how far could we go in applying such a policy? On this point he had no expression of opinion to give, because a provincial government would have no jurisdiction in the matter. It would probably be illegal from the constitutional point of view to enact laws prohibiting the exportation of wood into the United States.

He was decidedly opposed to the exportation of our raw material wood to the United States, and desired to have it manufactured here in Canada. There were, however, for the citizens of this country, consequences of such a policy that must not be forgotten. In making a contract the government had the right to say to the party buying our raw material: " We are going to sell you our wood, but you are going to manufacture it here in Canada." But as regards wood that does not belong to the government but belongs to private citizens, to parties that have freehold, or to farmers that own woodlots, would it be fair to say: " Now, Mr. So-and-so, you have a piece of wood on your property; we are going to forbid you by law to dispose of the wood as you would like "? It had therefore been decided that wood cut on Crown lands shall not be exported outside of Canada, but concerning the wood belonging to freeholders, no such steps had been taken. Thus the government was against exportation, desired to have our raw material converted into Canadian products, and was doing all in its power in that connection.

As regards the construction of new pulp mills in the province, he deprecated such construction excepting in territories needing development. Mr. Stadler had admitted that this was a right policy, because when he touched on the question of transportation he drew attention to the fact that in certain districts of our province transportation was

** This paper was presented at the Annual General Professional Meeting of The Institute, Quebec, February 16th, 1927, and was published in the Engineering Journal, February 1927.

too expensive, and that if the wood were not exported it would have to rot on the spot. The government did not favour the building of other mills in districts where an industry had already been established. Personally, Mr. Mercier did not favour the building of any other mills in the St. Maurice valley because he believed that the St. Maurice valley should be kept for the benefit of the mills already established. Moreover, he would advocate the creation of a reserve in that valley to provide the mills already established with all the raw material which they need in order to go on and work in perpetuity. Might he give an example of the policy?

Supposing, for instance, that the policy would cover all the territory of the province, and that report stated that we had rather fair forests in some sections of Ungava. Would it be right never to allow a pulp mill to be erected in that territory? Surely not; that would be a new district where industry should be established and it would do no harm to people on this side of the height of land, because pulpwood could not be transported from such a region to this side of the height of land. On the south shore there was a certain area from which naturally the wood should go into the United States, because there was no mill to be found there, and there was no way to bring the wood at a fair price of transportation. Such problems had to be faced. A way had to be found to utilize our raw material and not allow the province to lose it. We had mills at certain places and we must operate them. Mr. Stadler had the right idea, which had already been mentioned, why should not the owners of pulp and paper mills aid by buying the material that is going to the United States? Why not go to the settler who is opening up the land,—quite an important operation for Canada, for its prosperity,—why not go to him and say: "We are going to buy your wood and we are not going to allow you to send it to the United States?" It could be done, and it ought to be done.

Wood was to be found in the Abitibi region. Years ago there was no market for it. Settlers were obliged to let it rot or burn it. During the past few years, however, some of the companies on the St. Maurice valley had started to buy wood from the settlers of the Abitibi. Was he not right in saying that all companies operating mills for pulp and paper should give a hand and buy the farmer's wood? In so doing they would give an additional chance to their own forests to regenerate and to form reserves for future needs.

Discussion of Papers on The Mineral Deposits of Rouyn-Harricana Region in Western Quebec by Theo C. Denis and The Metal Mining Industry of Northern Ontario by W. R. Rogers, A.M.E.I.C.*

Mr. Theo. C. Denis.

Mr. Denis, in presenting his paper, pointed out that the province of Quebec measures 1,200 miles from north to south and 900 miles from east to west, and that it contained a great many things as yet undiscovered. As regards mineral resources, the last few years had brought to light two districts which were at present much in the public eye. These were the copper-gold area of Rouyn and the lead-zinc deposits of Gaspé.

Referring to figure No. 1, it would be noted that there were three main geological provinces in Quebec, namely, the Laurentian plateau, which occupies 95 per cent of the area, the St. Lawrence lowlands, and the Appalachian region to the east of the Champlain fault.

The rocks which constituted the Laurentian plateau belonged to the pre-Cambrian formation and were the oldest known. The most recent of them were 500 million years old, while the oldest, in which were found the mineral deposits of Rouyn, were about 1,500 million years old.

Here he would make a slight digression. Technical government services, such as the Geological Survey, the Federal Mines Branch, and the various provincial bureaus of mines, were often disparaged and reproached by the unthinking public, in that they did not discover mineral deposits, that they did not find mines, and their usefulness was questioned because they did not issue weekly official bulletins announcing that their officers had found large deposits of copper, or gold, or silver in such and such a place, and would the interested public please step in and stake them. It should be understood that the functions of these technical officers were not to prospect small restricted areas and dig with pick and shovel to uncover gold-bearing veins and lenses of copper ore, but to collect data which, when published, will guide and direct the prospector, pointing out to him, for instance, that on such maps as figure No. 1, compiled from geological explorations, the patches of dark rocks *A1*, *A2* and *A3* were worth prospecting for metallic substances, whereas he would probably spend his time looking for them in the spaces marked *A*.

Such a map informed the public that it is very unfortunate, but a fact, that in the province of Quebec all geological formations are older than the carboniferous strata,

* These papers were presented at the Annual General Professional Meeting of The Institute, Quebec, February 17th, 1927, and were published in The Engineering Journal, February 1927.

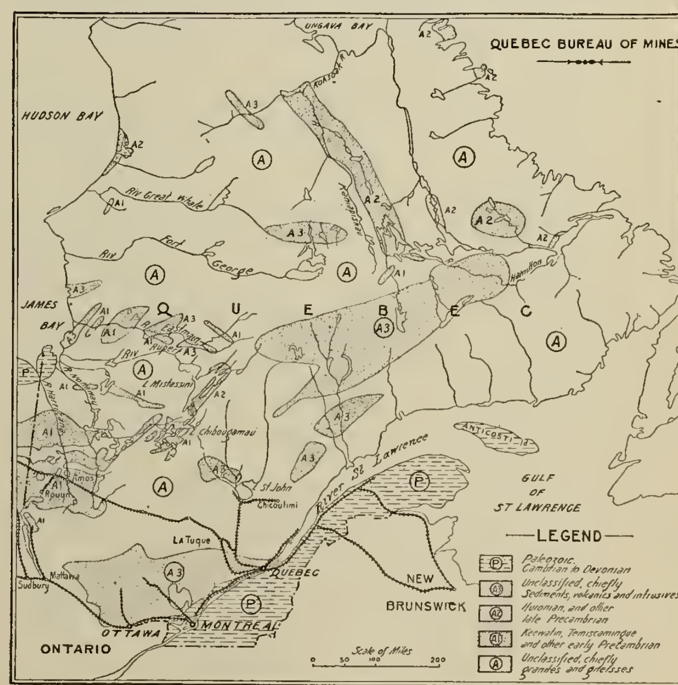


Figure No. 1.—Geological Sketch Map of the Province of Quebec, showing Relative Distribution of Pre-Cambrian Rocks (*A*, *A1*, *A2*, *A3*) and of Paleozoic Rocks (*P*).

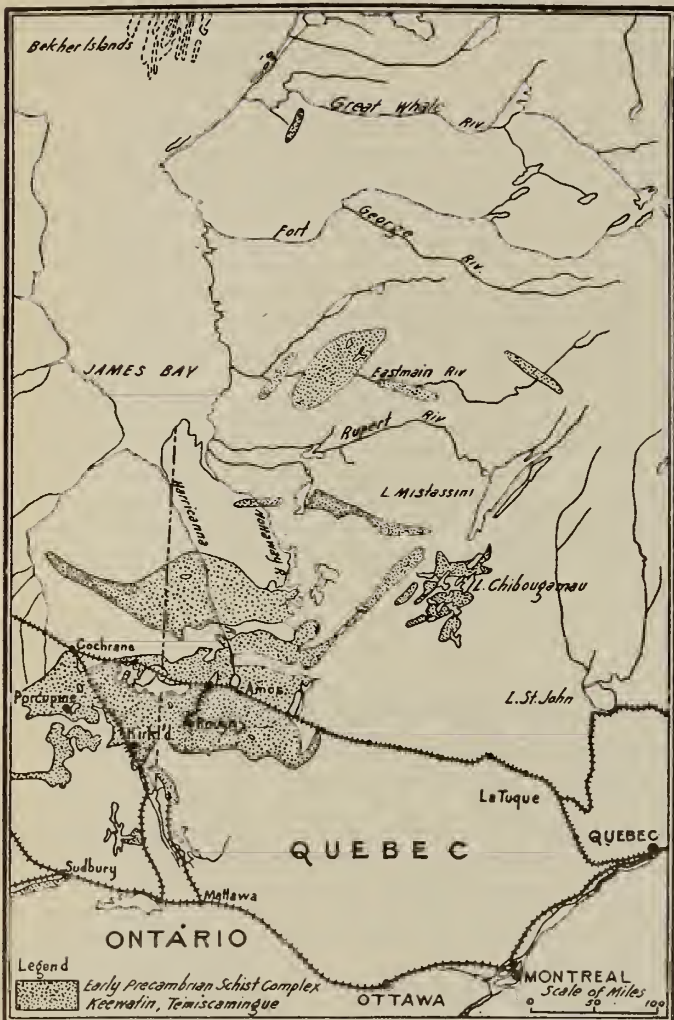


Figure No. 2.—Sketch Map of Keewatin Volcanics and Schist Complex in Western Canada, showing Geological Relation with Porcupine and Kirkland Lake Districts.

and that therefore it would be no use to bore or diamond-drill in search of coal beds in the formations underlying the rocks which show on the surface.

It was interesting to note that the very map from which this figure was prepared was first published eighteen or twenty years ago by the Geological Survey, with these patches differentiated, and that as early as 1904 and 1905 the reports and the maps of the Quebec Bureau of Mines drew attention to the similarity of the rocks in the Chibougamau region and in the lake Opasatika district to those of northern Ontario, where gold and silver were then being mined, so that these services were playing a most useful rôle of guidance in the development of our mineral resources.

The new mineral field of Rouyn in western Quebec extended from west to east for a distance of one hundred miles from the interprovincial boundary to beyond the Bell river. So far only the southern part of this patch of Keewatin rocks had been prospected, and all the outstanding discoveries had been made south of the railway. These discoveries were situated in the extension into Quebec of the outlier of Keewatin rocks, (see figure No. 2), which in Ontario gave rise to the camps of Porcupine, Kirkland lake, Matachewan and Larder lake.

While the principal discoveries had been made south of the Transcontinental railway, the outlier of Keewatin rocks in which the same conditions of mineralization were liable to occur covered in Quebec alone an area of 10,000 square miles, of which about one-quarter had been prospected. In fact, the Keewatin rocks extended 100 miles north of the railway in addition to many other patches.

Prospecting in that region was very arduous, and at times heart-breaking, for the country was remarkably flat and level, the height of land between the St. Lawrence basin and the Hudson Bay basin being practically imperceptible. Immediately after the Ice Age the whole region had been covered by a vast shallow lake, lake Algonquin, of which lake Abitibi was now the principal remnant. Sedimentation of clay and sand on the bottom of this lake had made a thick layer of superficial deposits, clay and sand hiding the underlying rock, and often covered by several feet of moss. Miles of walking through the bush were frequently covered without finding an outcrop of rock, which rendered difficult the finding of mineral deposits.

The deposits which attracted the prospectors to this region in 1921 and 1922 were the gold-bearing quartz veins, that is, true fissure veins filled with quartz containing iron-pyrites, pyrrhotite, arsenopyrite and free gold. Several deposits of this type were discovered, and considerable work and money had been expended on opening them up. So far it must be owned that the deposits of this nature had not come up to expectations, but while prospecting for fissure-vein types of mineral deposits, important lenticular masses of solid sulphides, copper, zinc, with gold, formed by replacement processes, had been discovered and they were now very much to the front. These deposits seemed likely to yield very large tonnages of ore, but they were all smelting ores, whereas the gold-quartz veins which for the moment had lost much of the interest which they raised at first, were ores which are milled for the extraction of gold only. He could not help believing, however, that eventually the straight gold ore deposits would retrieve much of the popularity which they had lost for the moment. This was what happened in the Kirkland lake camp in Ontario, the ores of which were straight gold ores. For long years they were neglected, practically despised, and now they were producing at the rate of $8,000,000 a year.

Mr. John A. Dresser.

Mr. Dresser remarked that our mining operations were being carried out in a larger measure than ever before by Canadian engineers from Canadian schools, whose methods were assuming a well established place in the mining practice of the world. To-day they were investigating, directing and doing technical work in Canada of which Canada might be justly proud. Mr. Rogers had shown that men of twenty-seven nationalities were engaged in the mines of Ontario, and we might safely believe that the broad condition prevailed in Canada of the best places for the best men and a free field for all. It was to the credit of our mining schools that their graduates were taking so large a part in Canadian mining to-day. He thought that from an economic, as well as a national point of view, it was encouraging that so much of the recent mining development was taking place in territory that was also suitable for industries other than mining. This meant co-operation in public services, a permanent population in the region and lasting use for roads, railways and power developments.

This happy combination of circumstances, like most of the good things in any favoured country, was due to geology. The clay belt was the drained floor of a great lake, as large as lake Superior. It had been formed when the retreat of the Labrador ice sheet passed north of the divide between the St. Lawrence basin and Hudson bay, and the accumulated waters were impounded between the front of the glacier and the height of land. As the ice retreated northward this lake was widened, or followed the ice, accumulating and depositing silt and loam of an observed thickness of 100 feet at least. When the ice barrier finally broke away, and the lake emptied into James bay, there was left a clayey floor which is drained by recent streams. This clay belt occurred mainly between elevations of 600 and 900 feet above sea level and occupied something like 35,000 square miles, rather more than half of it being in Ontario. Along the Bell or Nottaway river, near its eastern boundary, the breadth from south to north was about 200 miles. It extended westwards along the Canadian National Railway for more than 400 miles, growing narrower towards the west, and having irregular lobes, especially on the south.

Largely within the last dozen years, the clay belt had acquired a population of not less than 25,000. The clay belt differed greatly from the mining or the lumbering camp which might become exhausted in a region of no other industry. It undoubtedly offered the largest and best field for early railway expansion in eastern Canada.

It was not merely the dividends or the direct revenues to the public treasury that were important to the country, but the trade that accompanied and was made possible by the production of new wealth from the mines, the forests and the soil. While northern Ontario yielded $60,000,000 from its mines in a year, it was well known that not less than $40,000,000 of this were expended in labour, power and supplies, and almost entirely within that province. Adding to this the production of pulp and paper, and any surplus of the pioneer farmers, the sum would be nearly double that went out in trade, most of it ultimately to the city of Toronto and vicinity.

Similar conditions were now ready to be realized in Quebec, and might be looked for in other parts of this favoured area in both provinces when ready access to them had been provided.

Major G. G. Ommanney, m.e.i.c.

Major Ommanney thought that The Engineering Institute was to be congratulated on having included in its programme two such important papers connected with the mining industry. Having been engaged for a good many years in engineering work, and having been brought in recent years in fairly close contact with mining men and the mining industry through his present occupation in connection with the development work of the Canadian Pacific Railway, he believed that possibly The Engineering Institute had not taken quite the keen interest in mining and the mining development of the country that it perhaps should have done. He had the impression from his own experience and observation as a civil engineer that the average engineer, civil, mechanical, electrical, and so on, looked upon the mining industry as a curious but very interesting occupation with which they themselves had but little concern. Nothing was farther from the truth. Mr. Rogers in his paper had referred to the fact that one of the most important mineral deposits of the country, that is to say, the nickel-cobalt ores at Sudbury, had first been discovered through the construction of the Canadian Pacific Railway, and similarly cobalt was first discovered through the construction of the Temiskaming and Northern Ontario Railway.

Civil engineers were, of course, the men primarily engaged in building those railroads, and through their work on reconnaissance surveys were to a great extent connected with the earliest features of what might be called prospecting. At a later stage, mines could not be operated without some form of power, and here again the civil and electrical engineer came into an important degree. Later still, as the mine developed, all kinds of mechanical skill would be required, hoisting, crushing, grinding machinery of all kinds, in connection with which the civil engineer and the mechanical engineer again played their parts.

These remarks might sound rather obvious, but he ventured to think that a great many members of The Institute had not fully appreciated how closely engineers of all branches were concerned with mining development.

Dr. Chas. Camsell, m.e.i.c.

Dr. Camsell desired to refer to a subject touched upon both by Mr. Dresser and Mr. Rogers, namely, the influence of our mineral resources on colonization and the development of the country. That influence had existed all through the history of civilization. Going back to school-day memories he might recall that the Phoenicians were in the habit of going to Cornwall to get tin ore; Caesar stated that one of the reasons that influenced him in invading Britain was to get in touch with the tin deposits and the iron ore deposits, and there was another very important event in the history of the world which had a similar background. Humboldt said of the discovery of America by Columbus that, in making the voyage westward, Columbus was not actuated so much by the desire to find a new continent as by the wish to get a short route to the gold mines of Japan and the spice islands of the Pacific.

Coming now into our own more modern history, we saw the same thing in Canada and the United States. The discovery of gold in California brought a large number of people in there; the discovery of gold in British Columbia in 1860 was really the beginning of the development of that province; the position was similar in the Yukon in 1897, and history was now repeating itself in the province of Quebec, the same course of events having occurred in the province of Ontario. These were influences not usually considered when speaking of mining development. Mineral development had an enormous bearing upon colonization, and for that reason he had referred to the fact that the departments of mines and colonization are appropriately united under one minister in the province of Quebec.

Mr. Rogers had referred to the discovery of gold in Ontario, and had shown an old map depicting the early history of mining in Canada. As a matter of fact, mining went back a very long way on this continent. In prehistoric times, the Mound Builders had developed a civilization in Michigan long before the coming of the white man, based upon the deposits of native copper which they worked. Records of their activity were still to be seen in the upper peninsula of Michigan and in Wisconsin.

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The Institute's Library

On several occasions, announcements have appeared in the Journal regarding the status of The Institute's library at Headquarters and the service that is available to members through the library. Briefly, it contains about fifteen hundred volumes of text books and files of many of the leading technical periodicals, transactions of other societies and governmental reports. At the present time, the Library and House Committee of The Institute has under consideration a set of regulations governing the operation of the library. As soon as these regulations are approved by Council they will be made available for the information of the members.

In the meantime, it may be pointed out that the library service is prepared to advise any member as to what text books are available in the library on any particular subject, and if any particular text book is not available information as to where it may be secured will be supplied. The technical periodicals, transactions of other societies and governmental reports may be consulted at Headquarters, and for those members residing outside of Montreal who desire to secure copies of any particular article, these will be secured in photostat form at actual cost.

The Institute's library has been of service to a great many members, and it is hoped that when the regulations are published that even greater use will be made of the library in order that it may more effectively serve the interests of the members.

New Volume of Transactions Issued

Following the decision of Council to resume the publication of Transactions, the Publication Committee selected a number of the more important papers published in the Journal during the years 1923, 1924 and 1925 to be reprinted in the proposed volume of Transactions. This volume has now been issued and copies have been mailed to all members whose orders were received in advance.

A limited number of copies are still available, so that any member who, for one reason or another, did not subscribe in advance may procure a copy as long as the supply lasts. The subscription price is $3.00 per copy.

Toronto Varsity Centenary Celebration

The year 1927 marks the hundredth anniversary of the establishment of the University of Toronto and the fiftieth anniversary of the Faculty of Applied Science and Engineering of the University of Toronto, and as many members of The Institute are graduates or past students of "Varsity" the announcement of the programme for the Centenary and Semi-Centenary Celebration will be of interest.

The Centenary programme covers a period of five days, from Wednesday October 5th to Sunday October 9th, and includes the following features:—

Oct. 5th—Undergraduates' Ball.
" 6th—Registration; Address on "Aspects of Canadian History since Confederation"; Class and Faculty Luncheons; Procession to and formal opening of the Arena; Dedication of Carillon at Soldiers' Tower; Dinner at Hart House; Ringing of Carillon.
" 7th—Second Address on Canadian History; Luncheons; Interfaculty Track Meet; Conferring of Honorary Degrees; Graduates' Centenary Ball.
" 8th—Annual Meeting of Alumni Federation; Luncheons; McGill-Varsity Football Game.
" 9th—Divine Service.

The programme for the Centenary Celebration of "The School" has been arranged so as to allow those attending to take part in the main features of the general programme and at the same time provides a number of special events for the visiting "School Men."

The headquarters for the "School" celebration will be at the King Edward hotel, where registration commences on the morning of October 6th, and in addition to the items of the main programme, the following events have been arranged:—

Oct. 6th—Registration; Reunion Luncheons; Golf Tournaments; Installation of Obligated Engineers; Smoker.
" 7th—Golf Tournaments; Class Luncheons; Dinner Dance.
" 8th—Annual Meeting Engineering Alumni Association; Unveiling Galbraith Memorial; Reunion Banquet.

Those who attend this Centenary Celebration, even though it is only a few years since they have visited the university, will see a great many changes from the days when "The Old Red School House" was the centre of all their activities.

The celebration is being held during the early part of the college term so that all activities will be in full swing, and with the attractive programme that has been provided, there is little doubt that the occasion will be a memorable reunion for all Varsity men.

OBITUARIES

Paul Kircher, M.E.I.C.

Word has been received of the death of Paul Kircher, M.E.I.C., vice-president of Canadian Concrete Products Company, Limited, and resident manager of Union Switch and Signal Company, which occurred at Chicago, Ill., on July 10th, 1927.

Mr. Kircher was born in Chicago on July 27th, 1890, and received his education from the University of Illinois, from which he graduated with the degree of Bachelor of Arts in 1911, and from which he received the degrees of Bachelor of Science in civil engineering in 1912 and Civil Engineer in 1918.

His first work after graduation was as assistant engineer in the office of the city engineer at Chicago Heights, Ill., in 1911. Subsequently he was on the staff of the Illinois Central Railroad from 1912 until 1916, first on survey and construction work and later in 1914 as bridge designer. During 1916 and 1917 he was assistant engineer with the Universal Portland Cement Company, Chicago, engaged on the design of concrete barges. In 1917 he occupied various engineering positions with the Massey Concrete Products Corporation, Chicago, and since that date he had been specializing in reinforced concrete design, and at the time of his death, in addition to the two positions mentioned before, he was acting as engineering adviser to the president of the Massey Concrete Products Corporation.

The late Mr. Kircher joined The Institute as Member on March 23rd, 1926. He was also a member of the American Society of Civil Engineers and of the Western Society of Engineers.

Michael James Haney, M.E.I.C.

It is with regret that we record the death of Michael James Haney, M.E.I.C., president of the Port Credit Brick Company, which occurred at Kingston, Ont., on July 13th, 1927.

Born at Renoyle, County Galway, Ireland, in 1854, the late Mr. Haney commenced his engineering work after coming to Canada with the Kingston and Pembroke Railway in 1873. The following year he was division engineer with the Lake Ontario Shore Railway, New York. Two years later he occupied the position of locating engineer with the Kingston and Pembroke Railway and in 1878 he was construction engineer on the Chicago and Northwestern Railway. In 1879 he joined the staff of the Canadian Pacific Railway Company as superintendent of the Pembina branch. He continued with this company in various capacities for a number of years, being manager of construction on Section 15 and divisional superintendent in charge of construction and operation at Winnipeg and manager of construction of the Coast division.

Subsequently he was engaged in various large construction works. In 1887 he was associated with the late Mr. Hugh Ryan in building the Red River Valley Railway from Winnipeg to West Lynn, and in 1889 the Canadian ship canal at Sault Ste. Marie. During 1897-98 he was manager of construction of the Crow's Nest Pass Railway. Later he was contractor for the Hillsboro bridge, Prince Edward Island. Among his later works was the construction of the intake tunnel for the Toronto city water works in 1909.

The late Mr. Haney from time to time occupied many important positions, including the presidency of the Home Bank, vice-president of the Canada Steamship Lines, vice-president of the Quebec Steamship Company, director of North American Life Assurance Company and director of Canada Locomotive Company, Limited. He joined The Institute as Member on October 9th, 1902.

Frederick Hay Wrong, A.M.E.I.C.

The untimely death of Frederick Hay Wrong, A.M.E.I.C., of Ottawa, which occurred at Hillbre, Manitoba, on July 11th, 1927, while engaged on an aerial survey, has been received with sincere regret by his many friends throughout Canada. While in mid-air the hydroplane in which Mr. Wrong was flying burst into flames and crashed to the ground, bringing death to the three occupants: Flight Officer W. C. Weaver, pilot in charge; A. T. Eardley, photographic mechanic; and F. H. Wrong, A.M.E.I.C., survey officer.

The late Mr. Wrong was born at Chatham, Ont., on August 22nd, 1886. He was educated at the public school and collegiate at Chatham, and in 1912 received his degree of B.A.Sc. at the University of Toronto. During his college course he was engaged in various surveying works and upon graduation he joined the staff of the Topographical Survey at Ottawa.

Mr. Wrong was an official of the Topographical Survey, Department of the Interior, and was acting as navigational officer with the seaplane of the Royal Canadian Air Force which was engaged in taking aerial photographs for mapping purposes. He had only commenced this work this spring, having expressed his desire to be assigned to this practically new method of surveying and mapping. He had been connected with the Topographical Survey since 1909, at first during the summer survey seasons only, but later as a permanent official. He was a valued employee of the department and his connection with the Topographical Survery had taken him to many parts of the western provinces during the summers, where he had been engaged on many important surveys.

During the Great War he served overseas with the 12th Battalion, Canadian Engineers. In 1912 he received his commission as Dominion land surveyor, and in 1915 as Alberta land surveyor. Mr. Wrong was admitted to The Institute as Associate Member on September 25th, 1922.

PERSONALS

J. Terry North, Jr., S.E.I.C., is on the staff of the Canadian Marconi Company at Montreal. Mr. North graduated from the University of British Columbia in electrical engineering this year.

H. E. Mott, A.M.E.I.C., is chief engineer with the De Forest Radio Corporation, Limited, at Toronto. Mr. Mott graduated from McGill University with the degree of B.Sc. in electrical engineering in 1922 and following graduation joined the staff of the Canadian Marconi Company as test engineer; subsequently occupying the positions of engineer of test room, superintendent of works, and works engineer.

Oliver A. Barwick, A.M.E.I.C., has been appointed construction supervisor of the new head office building of the Royal Bank of Canada in Montreal. Mr. Barwick graduated from McGill University with the degree of Bachelor of Architecture in 1914. Following graduation he had extensive experience in various architectural works and for a number of years has been in private practice as architect and structural engineer in Montreal.

D. A. Killam, S.E.I.C., of Yarmouth, N.S., who graduated from McGill University (with honours) in civil engineering this year, has been appointed to the staff of the Abitibi Fibre Company, Limited, Smooth Rock Falls, Ont. During his university course Mr. Killam was engaged on hydrographic survey work with the Ottawa-Montreal Power Company and on paper mill construction with the Wm. I. Bishop Limited.

Col. C. N. Monsarrat, M.E.I.C., and P. L. Pratley, M.E.I.C., of Monsarrat and Pratley, consulting engineers, Montreal, have been appointed general consulting engineers of the McClintic Marshall Company of Pittsburgh, Pa., for the substructure and superstructure work on the new $22,000,000 Detroit-Windsor international bridge.

R. J. Sandover Sly, A.M.E.I.C., has been appointed construction engineer in addition to engineer and manager of townsite construction with the Newfoundland Power and Paper Company, Limited, Corner Brook, Nfld. He joined the staff of this company early in 1925 and has occupied the position in connection with the townsite construction since that date. In July of this year he was given the added responsibility of construction engineer.

Harold M. Thompson, A.M.E.I.C., is assistant chief draughtsman and manager of publicity with Messrs. Barford and Perkins Limited of Peterborough, England, having resigned his position with John Fowler (Leeds) Company, which he accepted upon returning to England last fall. While in Canada Mr. Thompson was chief mechanical engineer for Sawyer-Massey Company, Limited, Hamilton, Ont.

C. B. McDougald, A.M.E.I.C., is town clerk and manager of the town of Bridgewater, N.S. Following his service overseas, Mr. McDougald was resident engineer with the Davison Lumber Company, Limited, at Bridgewater, N.S., after which he held the same position with the Nova Scotia Wood Pulp and Paper Company, Limited, and Medway Hydro-Electric Power Company, Limited. Later he was appointed resident engineer with the Provincial Highways Board of Nova Scotia.

A. G. Moore, S.E.I.C., who graduated from the Nova Scotia Technical College in 1925, has joined the staff of the electrical department of the Asbestos Corporation of Canada, Thetford Mines, Que. Mr. Moore had only recently moved to Montreal, where he was on the engineering staff of the Bell Telephone Company of Canada, having previously been located at Wilkinsburg, Pa., with the Westinghouse Electric and Manufacturing Company on their students' test course.

J. H. Summerskill, A.M.E.I.C., who has been on the engineering staff under the director of engineering of the B. F. Goodrich Company at Akron, Ohio, has been appointed material engineer for this company. Mr. Summerskill is a graduate of McGill University, having received his degree in electrical engineering in 1914 and in mechanical engineering in 1915, and was for a number of years with the Riordon Company, Limited, first in Mattawa and later at the head office in Montreal.

Geo. R. Pratt, A.M.E.I.C., fuel engineer for the government of Alberta, has resigned to enter private practice in Winnipeg, specializing in fuel and power development. Prior to his appointment with the government of Alberta Mr. Pratt held the position of mechanical and fuel engineer with the Canadian Pacific Railway for the western lines. Mr. Pratt is the author of the booklet entitled "Coal Truths," which was issued by the Coal Truth office of the Mines Branch of the province of Alberta in 1922.

R. E. Butt, A.M.E.I.C., has resigned from the staff of Messrs. General Motors New Zealand, Limited, to accept a position with Messrs. B. J. Dunsheath Limited, engineers and importers, Wellington, N.Z. In 1922 Mr. Butt was chief engineer of Messrs. Kindred and Company of Wolverhampton, England, which company was a subsidiary of Messrs. Bostock and Hargrove Limited, and in 1924, due to trade depression, Mr. Butt was transferred to the parent company. Early in 1925 Mr. Butt went to New Zealand, where he was engaged on various temporary works until his appointment with General Motors New Zealand Limited.

ELECTIONS AND TRANSFERS

On the 18th of July a committee which was appointed by Council at its meeting on June 21st for the purpose of opening the ballot for the election of members, canvassed the ballot, and the following elections and transfers were effected:—

Associate Members

BOULIAN, Job Ivan, constrn. engr. Southern Can. Power Co. Ltd., Montreal, Que.

GALLER, Leo C. E., (Univ. of Vienna), designing engr. with Montreal Water Board Commission, Montreal, Que.

LINK, Norman Archibald, general contracting business, Regina, Sask.

ROGERS, G. H., general commercial engr. Bell Telephone Co., Montreal.

WILLIAMS, Hugh Chester, asst. to res. engr., Dept. of Pub. Highways, Ont., Chatham, Ont.

Juniors

BOIVERT, Charles Henri, asst. to ch. engr. Quebec Public Service Commn., Quebec, Que.

BRADLEY, Robert Auldom, on Welland canal constrn. as instrumentman, Merritton, Ont.

Affiliate

ELKINS, William Henry Pferinger, Diploma R.M.C. staff officer artillery, headquarters National Defence, chairman, Standing Arms Committee, Ottawa, Ont.

Transferred from the class of Associate Member to that of Member

CARTER, Hugh Clay, director of public works under colonial office to the Govt. of British Honduras, Belize, British Honduras.

Transferred from the class of Junior to that of Associate Member

COSSITT, Murray Frederick, engr. for town constrn., dept. of the Nfld. Power & Paper Company, Ltd., Corner Brook, Nfld.

Transferred from the class of Student to that of Associate Member

GAUTHIER, J. P. Irene, C.E. and B.A.Sc., (Laval Univ.), with Dom. Water Power Branch as asst. engr. to chief Quebec Dist. engr., Outremont, Que.

Transferred from the class of Student to that of Junior

CREGEEN, Kenneth Thomas, B.Sc., (McGill Univ.), Sun Life Assurance Co. of Canada, engr. i/c building mtce., Montreal, Que.

KEITH, William Hargreave, B.A.Sc., (Univ. of Toronto), asst. engr. i/c waterworks and pavements design and constrn. and chief dftsman, twp. of Etobicoke, Islington, Ont.

MURTHA, Leo, with Can. Inspection & Testing Co. Ltd., Toronto, i/c inspection and testing in the mfr. of concrete sewer pipe at plant of Independent Concrete Co. Ltd., Woodstock, Ont.

EMPLOYMENT BUREAU

Situations Vacant

DRAUGHTSMEN

Electrical draughtsmen experienced in hydro-electric power station design, and mechanical draughtsman experienced in paper mill design. Apply Box No. 168-V, Engineering Journal.

CIVIL ENGINEER

A paper company in the province of Quebec requires a recent graduate in civil engineering for their operating staff of the woodlands department. Apply Box No. 169-V, Engineering Journal.

CORRESPONDENCE

Description of a Method used for Driving Piles

Riverbend, Que., June 27, 1927.

To the Editor,
The Engineering Journal, Montreal, Que.
Dear Sir:—

During the construction of the extension to the grinder room of the Riverbend mill of Price Brothers and Company, Limited, and after the pile driver had been moved to another location it was decided to drive a few more piles in the west wall of the building.

It was thought that there must be some cheaper method of driving the piles than by moving the pile driver back a distance of about 700 feet, so it was decided to use our type "EA" industrial crane with a No. 9-B-2 McKiernan-Terry hammer.

To the inside of the jaws of the hammer a three-foot length of 18-inch diameter steel pipe was bolted to act as a guide for the pile and also to hold the pile in position. Then, to strengthen this, two pieces of 4- by 8-inch B. C. fir were strapped to the channel guides on the hammer and bolted in turn to the pipe, (see figure No. 2). The hammer was then ready.

An iron collar was made to fit loosely around the pile, and to

Figure No. 1.

Figure No. 2.

this collar four guy ropes and a sling to be used from the bucket line of the crane were attached.

Next, about twelve feet from the head of the pile, two drift pins were driven on which the steel collar with guy ropes and sling rested, and to the sling the crane bucket line was attached.

The crane then lifted a pile with the load line and moved the pile to position. The pile was then plumbed by the guy lines; the drift pins preventing the collar from slipping down. The load line was then detached from the pile and the hammer was lifted and dropped over the pile, but not resting on it. The crane bucket line, which was attached to the sling on the iron collar, was then tightened and held in that position and the hammer started, the load line being allowed to run free but always under immediate control.

When the pile had been driven until the hammer reached the collar, (see picture No. 2), the hammer was stopped and the bucket line was slackened and dropped down until the collar rested on the drift pins. The guys were tightened and strain taken on the bucket line and the hammer started again.

The length of piles used was fifty feet, and after the pile had been driven about thirty feet the guys were dropped, depending on the penetration to hold the pile in position. The piles were driven to an average of forty-eight feet cut-off without any difficulty.

The above method was decided upon by Mr. C. H. Jackson, my assistant, and myself.

D. J. Emery, A.M.E.I.C.
Construction Supt., Price Brothers & Co., Ltd.

Canadian Electrical Code

On June 14th to 18th, the special committee on Canadian Electrical Code of the Canadian Engineering Standards Association convened in Winnipeg to discuss the revised draft code. This draft covers Part I, "Rules and Regulations for Electrical Installations. In, On, or Over Buildings, using potentials of 10 — 5,000 volts."

The meeting, which was presided over by W. P. Dobson, M.E.I.C., laboratory engineer, Hydro-Electric Power Commission of Ontario, was attended by representatives of various organizations from practically every province in the Dominion.

In the preparation of this latest draft, revisions approved at a meeting of the Code Committee held in Ottawa on May 10th and 11th, 1926, and the latest revisions to the National Electrical Code have been considered.

As a result of the deliberations of the committee, the code has been approved for printing, with considerable revisions, which include renumbering to correspond as closely as possible to the present numbering of the national electrical code. Committees have reported on radio installation and grounding, and these reports have been incorporated in the revised draft. It is also proposed to add an appendix covering methods of resuscitation from electrical shock.

This first edition will cover generally rules and regulations for electric wiring and installation of electrical apparatus. It is the endeavour to make these code rules universal practice for Canada. Provincial authorities will, it is expected, adopt them for their own use, the necessary enabling legislation being passed to give official endorsement of the code.

An attempt has been made to get away from the multiplicity of regulations now existing in provincial and municipal by-laws, and to make the operation of these rules Dominion wide. This Canadian code is unique in this respect that it combines regulations covering both fire and accident hazards. In drafting the rules, advantage has been taken of existing codes in Canada and the United States, and it is believed that the Canadian code is a distinct step in advance, insofar as its rules provide for the safety of the public in the use of electricity in domestic and industrial service.

Sections dealing with specifications for electrical apparatus and rules for outside wiring will follow, and when the code comes into full operation approvals of electrical apparatus will be given by a Dominion Government laboratory which will be part of the National Research Laboratories, the proposed establishment of which has recently been announced by the Department of Trade and Commerce.

Trade Publications

The Horton Steel Works Limited has issued a booklet entitled "Meeting Railroad Requirements with Horton Steel Tanks." It describes standard steel structures for any type of storage a railroad might require. The main part of the booklet is given over to illustrations and descriptive matter regarding conical-bottom and ellipsoidal-bottom tanks, the two standard designs commonly used for roadside delivery service, and water softening in conjunction with these types. Information is given regarding sludge removal, the type of spout and fixtures to use in cold climates, and the special heating arrangements available for extreme northerly locations. Other types of tanks are described briefly, and, in addition to the tables for elevated railroad tanks and flat-bottom tanks, the booklet includes a diagram for calculating pipe sizes, discharge, velocities and loss of head, which is of value to water service men.

Link-Belt Company, Chicago, Ill., has issued a bulletin entitled "Link-Belt All-Purpose Crawler." This bulletin illustrates and describes the company's shovels, draglines and cranes. The company has also issued a descriptive leaflet of their new anti-friction belt conveyor idler and return rolls. The equipment described in this leaflet has been under development by the company for the past three years.

De Laval Steam Turbine Company, Trenton, N.J., has recently published two leaflets, one entitled "De Laval Pumps at Independence, Mo." and the other "Pumping Chicago's Water." Both these leaflets describe the equipment installed by this company at these two works.

The Ontario Gypsum Company, Limited, Paris, Ont., has issued a folder entitled "Gypsum Products" containing booklets descriptive of the various products of this company. The booklets already received include Section A entitled "Insulex," Section A-2 "My Home," Section B "Gypcrete Slab Construction," Section D "Precast Short Span Roof Tile" and Section F "Partition and Furring Tile."

The Department of Railways and Canals, Canada, has issued Circular No. 8 entitled "The Highway, the Motor Vehicle and the Tourist in Canada, 1926," which contains information as to highway regulations and statistics relative to motor vehicles and tourist traffic in Canada. This booklet was prepared by the late Commissioner of Highways, A. W. Campbell, M.E.I.C., whose death occured on May 9th, 1927, and was practically the last work to receive Mr. Campbell's attention.

BRANCH NEWS

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

On Saturday, June 25th, a party of members of the branch paid a visit to three of the exchanges of the Alberta Government Telephones located in the city. While the inspection proved of extreme interest it must be admitted that the intricacy of some of the automatic apparatus proved somewhat of a stumbling block to many of those who had not studied in particular this branch of engineering. The courtesy of the officials was much appreciated, as was also the careful manner in which the operators in charge of exchanges explained every detail, putting through special calls in order to simplify the demonstration. Anyone who has visited an automatic telephone exchange will have noticed the multiplicity of parts and the extraordinarily complicated devices employed to accomplish a single telephone connection. The methods of operating rural and long distance lines were fully explained. The visitors were fortunate in hearing about the cross-continent broadcasting for Confederation Day from one of the experts from Ottawa who, by map and radio apparatus, explained fully the routes to be taken on the telephone wires to the various broadcasting stations throughout the Dominion. The linking up of telephone lines, amplifiers, and broadcasting apparatus in conjunction was only made possible after exhaustive study and organization and was appreciated especially by crystal set owners.

The first automatic telephone in the city was installed in 1909 and has been constantly kept up to date, and great credit is due the department and its officials for the splendid efficiency maintained and the manner in which the exchanges are kept, as well as the modern buildings in which these are housed. It was evident throughout the trip that both the staff and the department as a whole live up to the reputation of courtesy they have gained to the public, together with promptness and efficiency of service.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

Visit to Gatineau River Power Developments

Although various features of the hydro-electric power developments, which have been changing the valley of the Gatineau river for the past two years, have been ably described in recent papers presented before The Institute, a full application of the extent of this great undertaking can be secured only by a visit to the actual works.

Such a visit was the goal of the annual summer excursion of the branch, when one hundred and twenty-eight members and friends left the Windsor street station at 11:30 p.m. on Friday, June 24th, bound for the Gatineau valley.

The party, travelling on a special train equipped with five pullman coaches and two dining cars, proceeded by night over the lines of the Canadian Pacific Railway to Chelsea, Que.

After an ample breakfast on their own train, the members of the party embarked at 9 a.m., on the work train of the contractors, the Fraser Brace Engineering Company, to descend a hundred feet into the valley along a switch-back railway to the Chelsea power plant. Heavy rain descended on the party but not before a thoughtful host had provided all with serviceable waterproofs.

Walter Blue, M.E.I.C., manager of development for the Gatineau Power Company, the host of the branch, welcomed the visitors to the works, and for two hours the party inspected every detail of the Chelsea development, where three of the five 34,000-h.p. units were in operation. During this time members of the excursion were photographed individually and in groups by the cameraman, under the direction of B. E. Norrish, A.M.E.I.C.

Boarding the work train again, the party travelled over the Chelsea extension line to Farmers rapids, descending immediately to the power house. Here one of the five 24,000-h.p. units was in operation. During the hour of inspection, a violent electric storm was in progress which more or less drenched some of the ardent excursionists.

However, the well-ordered work train speedily returned the party to their own dry coaches, where lunch awaited them, and at 1 p.m. the train left Chelsea to reach Paugan Falls at 2.30 p.m.

The site at Paugan, besides its great natural beauty, proved to be the most interesting of the three developments visited, as it is still in the early stages of construction and offered an excellent opportunity for inspecting the extensive plant of the contractors. An observatory on the hill provided such a splendid panorama of the works that it was worth the climb to its level.

Warning whistles recalled the members to their train and at 5 p.m., the party was again on its way to reach Montreal at 10 p.m., after what was proclaimed a most enjoyable and instructive outing, long to be remembered by all who were fortunate enough to be present. The organizers, J. L. Busfield, M.E.I.C., and C. K. McLeod, A.M.E.I.C., were warmly congratulated on the success that had attended their efforts.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

Model of Quebec Bridge

As their share of the decorations of the city for the Confederation Jubilee, July 1st, the Peterborough Branch designed, constructed and erected a scale model of the famous Quebec bridge. The photograph shows the completed bridge spanning George street, Peterborough, in a prominent location.

The work was done entirely by members of the branch in spare time, commencing June 11th; the bridge was erected on the night of June 27th and the finishing touches added by June 30th.

The model was constructed in sections to a scale of approximately 1/45, the erection during traffic hours on the main street attracting a large and interested crowd. The bridge was finished with aluminum paint and decorated with coloured electric lamps. Replicas of the E. I. C. badge and particulars of the original Quebec bridge were posted up on the piers.

That the efforts of the engineers were much appreciated was evidenced by the many favourable comments heard and by the following editorials from the *Peterborough Examiner:*

> Vision was exemplified in the selection by the Peterborough Branch of The Engineering Institute of Canada of the Quebec bridge as a suitable subject to be emphasized in connection with the Diamond Jubilee.
>
> The building of this great structure across the St. Lawrence remains one of the outstanding achievements of Canadian engineering genius recorded during the sixty years of Confederation, and the local engineers did well in deciding to adopt a model of the huge bridge as their contribution to the Diamond Jubilee scheme of decoration.
>
> The result is a most striking arch that in its originality of design and in its faithful duplication of the original structure is not likely to be surpassed anywhere in the Dominion.
>
> The members of The Engineering Institute have devoted considerable time to this enterprise, and have done all the work of planning, building, wiring and erecting the arch, but they have the satisfaction of knowing that they have achieved a striking and unique feat of decorating.
>
> The Quebec bridge arch, situated near the Y.M.C.A., should be inspected by every citizen; it is well worth a visit. —*Peterborough Examiner, June 29th, 1927.*

The bridge has since been given by the branch to the Board of the Peterborough Exhibition, and will be re-erected in the fall in the Exhibition grounds.

J. A. G. Goulet, M.E.I.C., was chief designer, Paul Manning, A.M.E.I.C., the financier, who obtained a grant for material from the City Decoration Committee, while John Barnes, A.M.E.I.C., was resi-

Figure No. 1.—Model of Quebec Bridge Erected by Peterborough Branch.

dent engineer and gang boss. A total of 260 man-hours was expended in the work, of which some 57 hours go to the credit of Mr. Barnes.

Peterborough Personal Notes

R. B. Rogers, M.E.I.C., completed forty years as a member of The Institute on May 12th, 1927. Mr. Rogers was last year elected by the Council to life membership in The Institute.

P. P. Westbye, M.E.I.C., was recently elected councillor of the American Society of Mechanical Engineers.

A. L. Killaly, A.M.E.I.C., is this year's president of the Peterborough Rotary Club.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I C., Secretary-Treasurer.

A special dinner-meeting was held in the Y.W.C.A. rooms on July 8th, 1927, at 6.45 p.m., the occasion being the annual visit to the branch of R. J. Durley, M.E.I.C., general secretary of The Institute.

G. H. Kohl, M.E.I.C., chairman of the branch, welcomed Mr. Durley and expressed the general feeling when he said it was a pleasure to have Mr. Durley with us again and to listen to his talk on The Institute.

A short programme had been arranged as follows:—

(1) Piano solo—Miss Treva Richardson, L.L.C.M.
"Revolutionary Etude," by Chopin.
(2) Monologues and recitations—Mr. Roy Blaney.
(3) Vocal solo—Mr. W. J. Thomas.
"Friend of Mine," by Davies.
"Absent," by Metcalfe.
(4) Piano solo—Miss Treva Richardson, L.L.C.M.
"The Little White Mouse," by Ibert.
(5) Vocal solo—Mr. W. J. Thomas.
"The Trumpeter," by Dix.
(6) Piano solo—Miss Treva Richardson, L.L.C.M.
"The Juggleress," by Moskowski.
(7) Vocal solo—Mr. W. J. Thomas.
"The Deathless Army," by Troteri.

The chairman called upon Mr. Durley, who expressed pleasure in being back again with the Sault members. Since his last visit here he said he had attended the professional meeting in the Maritime provinces and also the general meeting of The Institute at Quebec in February, which was a great success. In his remarks regarding the running of a branch he said that meetings are somewhat different to a general meeting as the papers were more intimate than those of a general meeting. It was impossible to get a good discussion of a paper without first having it printed and distributed among the members. A man belonging to an institute should be a man of broad ideals. The discussion of a paper and not its reading is the real life of a meeting. He suggested that the members of a branch should prepare and give a criticism of a paper already printed in The Journal, and that members should be secured by the branches instead of leaving it to Headquarters. He gave a general outline of the Headquarters and the running of The Institute.

Mr. Kohl, in leading the discussion which followed Mr. Durley's address, said he wished to congratulate Mr. Durley and headquarters upon The Journal. He moved a hearty vote of thanks to Mr. Durley, which was unanimously supported by all the members.

The members all look forward to this annual visit of Mr. Durley's and we hope to have him with us again next year.

The Forty-second

ANNUAL GENERAL *and* GENERAL PROFESSIONAL MEETING

of

THE ENGINEERING INSTITUTE OF CANADA

will be held in MONTREAL, QUE.

The Annual Meeting will be convened at Headquarters (in accordance with the By-Laws) on Thursday, January 19th, 1928, at 8.00 p.m., and will be adjourned to reconvene in Montreal, February 14th, 15th and 16th, 1928.

Further Details will be made available later.

Preliminary Notice

of Applications for Admission and for Transfer

July 18th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in September 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ASHFORD—ARTHUR GEORGE, of West Toronto, Ont., Born at Newport, England, 21st October, 1879; 1906-10, engrg. asst., Alexandra docks and ry., Newport; 1910-15, sr. instrumentman, ry. location, constrn. and mtce., C.P.R.; 1915-19, officer in Can. Engrs.; 1919-21, engrs. dept., Alexandra docks and ry., Newport; 1921-26, contractors' ch. engr. on highway constrn., Bristol, England; 1927 to date, transitman, C.P.R.

References: C. C. Kirby, W. W. Benny, R. C. F. Alexander, V. A. G. Dey, P. T. Davies.

CUNNINGHAM—JOHN FERGUSON, of Winnipeg, Man., Born at Manchester, England, Oct. 12th, 1895; Educ., high school and spec. student in chemistry at Univ. of Man.; 1909, locomotive running repairs, C.P.R. shops, Calgary; 1911-13, elect'l constrn. and repairs, Burnham Firth Elect. Co. and Pennie Newman Electric Co., Edmonton; 1914, engr. and paymaster, Sturgeon river development, Dom. Public Works, Edmonton; 1915, engr. on drilling tests for footings of present Banff bridge, D.P.W., Edmonton; 1916-19, overseas with Can. Engrs; 1919-20 and 21, mgr. of Cunningham Bros. drilling and testing coal leases, Edmonton dist., water supply, Alta. Prov. Govt. and C.N.R.; sessions of 1921-22, 1922-23 and 1923-24, asst. in civil engrg., thermodynamics and hydraulics labs., Univ. of Man., Winnipeg; seasons of 1922-23 and 24, engr. master, dredge Plamondon, D.P.W., Winnipeg; 1924 to date, supt. of testing labs., dept. of civil engrg., Univ. of Manitoba.

References: J. B. MacPhail, S. C. Ells, J. N. Finlayson, N. M. Hall, J. E. St. Laurent, F. G. Goodspeed, G. H. Cagnet, E. P. Fetherstonhaugh, L. R. Brereton, R. W. Moffatt.

KEARNEY—GRAHAM, of Montreal, Que., Born at Renfrew, Ont., Feb. 6th, 1883; Educ., B.Sc., McGill Univ., 1911; 1902-04, constrn. work and operating with Renfrew Power Co., Ltd.; 1905-06, i/c installation and operation of first commercial lighting plant in Haileybury, Ont., for Beach Bros.; 1907-09, constrn. and line mtce. followed by a year's experimental work with the Electrical Orefinding Co. in Cobalt district and Mexico; 1911-17, with Can. Gen. Electric Co. as apparatus salesman, Prince Rupert agent, Victoria agent and Vancouver dist. sales engr.; 1917-19, professor of electrical engrg., Tangshan College of the Chia Tung Univ., China; 1919-26, with Anderson Meyer & Co., Ltd., as follows:—1919-21, engrg. sales work; 1921-23, i/c engrg. sales, Tientsin branch office; 1923-25, mgr. of Canton branch; 1925-26, mgr. of Hongkong and Canton branch offices; at present, engrg. sales, Can. Gen. Electric Co., Ltd.

References: C. V. Christie, F. Newell, J. H. Trimingham, P. S. Gregory, G. M. Hudson, W. G. Mitchell, A. A. MacDiarmid.

MACAULAY—ROBERT VERNON, of Westmount, Que., Born at Lindsay, Ont., Feb. 20th, 1891; Educ., B.A.Sc., Univ. of Toronto, 1912; 1908-09, ore dressing and handling, King Edward, Drummond and Temiskaming mines, Cobalt; 1910-11 and 12, electric installations, mtce. and testing, Can. Westinghouse Co., Hamilton; 1912-13, 1 term instruction staff, Univ. of Toronto; 1913-14, traffic supervisor and div. commercial engr., Bell Telephone Co.; 1914-19, war service overseas; 1919 to date, with Bell Telephone Co., as:—1919, asst. div. traffic engr., Toronto; 1920, manual equipment traffic engr., Montreal; 1921-23, general traffic engr.; 1924-25, equipment engr.; 1925-27, plant extension engr.; at present, acting ch. engr.

References: W. C. Adams, A. M. Mackenzie, S. C. Nowlan, J. L. Clarke, J. S. Cameron.

NAISH—SIDNEY GORDON, of Lachine, Que., Born at Halifax, N.S., Aug. 21st, 1900; Educ., B.Sc., Durham Univ., 1923; 1919-24, premium apptce. with Sir W. G. Armstrong Whitworth & Co., shipbuilding, marine engrg., locomotive bldg., gun mounting, etc.; 1925-26, responsible for transfer of four 8" mark 1. gun mountings from Elswick works, Newcastle-on-Tyne to Openshaw works, Manchester; at present, engr. Mtl. div. plant dept., Bell Telephone Co.

References: T. E. Naish, W. H. Slinn, A. C. Oxley, A. M. MacKenzie.

SPENCER—WALTER HUTCHINS, of Westmount, Que., Born at Montreal, March 4th, 1886; Educ., M.E. and E.E., McGill Univ., 1908 and 09; 1906, Northern Electric Co.; 1907-8-9, Can. Westinghouse Co.; 1911, dist. constrn. foreman with M.L.H. & P. Co.; 1912-16, elect'l contractor with offices in Montreal and Ottawa; at present, designing and constructing with M.L.H. & P. Co.

References: C. K. McLeod, L. A. Kenyon, C. V. Christie, R. M. Wilson, W. S. Vipond, R. H. Balfour.

TOWNSEND—CHARLES ROWLATT, of Grand'Mere, Que., Born at Victoria, B.C., Feb. 9th, 1891; Educ., Univ. of N.B., B.Sc. 1920 and M.Sc. 1923; 1920-22, with air service div. of Laurentide Co. on aerial photography; on ground covered by photographs working up a legend for the photographs; aerial sketching of various topographical features, etc.; 1923 to date, with logging division i/c of field work of various projects; 1924, i/c constrn. of marine ry; i/c hydrographic survey of lake Manouan and lake Kempt; preliminary and reconnaissance survey for location of a flume from dam B on lake Manouan to lake Watoussi; surveys of various rivers, dams, roads, etc., in connection with logging operations.

References: E. Wilson, H. O. Keay, H. E. Bates, T. R. McLagan, J. F. Lawrence.

WADDINGTON—GEORGE WILFRED, of Vancouver, B.C., Born at Nanaimo, B.C., April 6th, 1894; Educ., 4th year student in mining engrg. at Univ. of B.C.: 1912-15, intermittently employed as chainman by A. G. King; 1915-19, in C.E.F., enlisted as private; 1915, corporal in C.F.A.; 1917, corporal in Can. Army Medical Corps; 1919-20, rodman (but running transit and levels) in constrn. dept. of C.N.R.; 1920 to date, mine surveyor i/c at Middlesboro Collieries, Ltd., Merrit, B.C.; 1925-26 and 1926-27 (winters), attended Univ. of B.C.

References: W. H. Powell, R. W. Brock, E. A. Wheatley, F. P. V. Cowley, G. A. Walkem, J. F. Frew, S. F. Workman, W. G. Swan, H. K. Dutcher.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

AMES—FREDERICK THOMAS, of Lahore, India, Born at Folkestone, England Sept. 28th, 1887; Educ., boarding school, Sandwich, Kent, London College of Preceptors' certificate to matric.; 1903-06, articled pupil to boro. engr.;

1906-07, asst. architectural and bldg. constrn. with T. Tunbridge, Folkestone; 1907-13, dftsman, rodman, instman and resident engr. on constrn. of G.T.P. Ry.; 1913-16, asst. engr. with R. W. Jones, Edmonton, Alta., on railway and drainage projects; 1917-20, supt. i/c location, constrn. and operation Lacombe & N. W. Ry. for dept. of rys., Govt. of Alberta; 1921, asst. engr. i/c location and constrn. of Lusear Collieries branch ry., Leyland to Lusear Collieries; 1922-24, officer i/c surveys, Gyaing-Attaran surveys div., P.W.D. irrigation branch, Burma, India; 1924-25, res. engr. highway location and constrn. for Prov. Highway Dept., Edmonton, Alta.; 1926 to date, executive engr., Indian State Rys. i/c No. 3 div. Kangra Valley Railway constrn., Punjab, India.

References: R. W. Jones, W. S. Fetherstonhaugh, C. Ewart, A. J. Gayfer, G. N. Stowe, R. J. Gibb.

DONALD—JAMES RICHARDSON, of Montreal, Born at Montreal, Oct. 7th, 1890; Educ., B.A., B.Sc., McGill Univ., 1913; 1913, chemist, Nichols Chemical Co.; 1914-17, general chemical engrg., J. T. Donald & Co., Ltd.; 1917-18, i/c inspection of explosives and chemicals, Imperial Ministry of Munitions; 1919-21, chemical engr. and technical supervisor, Can. Packing Co., Ltd.; 1921 to date, with J. T. Donald & Co., Ltd., 1922 to date, managing director.

References: A. Surveyer, J. H. Hunter, F. B. Brown, L. R. Thomson, G. R. MacLeod, J. L. Busfield.

MUNTZ—ERIC PERCIVAL, of Hamilton, Ont., Born at Toronto, July 21st, 1892; Educ., B.A.Sc., Univ. of Toronto, 1914; 1911-12-13, chainman, rodman and instrumentman, constrn. C.N.R.; 1914-15, instrumentman, Welland Ship Canal; 1916-19, overseas in France and Palestine, 1918-19, captain, 2nd in command, 1st bridging co., Can. Ry. troops in Palestine; 1920, supt. for A. E. Rigby, Grand River Ry. betterments; 1920-22, constrn. mgr. and engr., J. B. Nicholson, Ltd.; 1923 to date, president and ch. engr., E. P. Muntz Inc. and E. P. Muntz Engrg. Co., Ltd., at present, consulting engr. to Lehigh Valley Coal Sales Co.

References: J. L. Weller, E. H. Darling, B. Ripley, E. G. Cameron, A. P. Linton, T. R. Loudon.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

CONSTABLE—LAWRENCE EARL, of Niagara Falls, Ont., Born at Seaforth, Ont., Oct. 11th, 1893; Educ., high school, night courses at Niagara Falls Tech. School and home studies; June 1917 to Aug. 1926, with H.E.P.C. as follows:—June to Dec. 1917, reconnaissance and preliminary surveys as rodman; 1918-19, dftsman, rodman and instrumentman, inspector i/c erection of wood-stave pipeline, concrete inspector on mass and reinforced concrete; July to Oct. 1919, asst. to Prof. R. W. Angus i/c layout and constrn. of experimental models of the intake for the Queenston-Chippawa development of H.E.P.C.; Nov. to Dec. 1919, inspector i/c concrete tunnel lining at the Ont. Power Co. plant; Jan. 1920, made and plotted survey of ice jam in lower Niagara river; Feb. to May 1920, instrumentman on location and constrn. of three miles of constrn. railroad; 1920-22, inspector i/c rock scaling, canal lining, canal paving, constrn. of diverter and erection of structural steel in screen house at the Queenston power house; 1922-26, inspector i/c on reinforced concrete in power house structure at various times, inspector i/c erection of steel plate penstocks, instrumentman on excavation, tunnelling, substructure, etc.; 1926 to date, promotion of new business for the Niagara Electric Service Corp., Niagara Falls, N.Y.

References: H. G. Acres, T. H. Hogg, R. L. Hearn, W. Jackson, L. L. Gisborne, T. S. Scott, H. L. Bucke.

CRAWFORD—ARTHUR WESLEY, of Ottawa, Ont., Born at Point Edward, May 4th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1914; 1914-17, overseas with 2nd Div'l Signal Co. as N.C.O. and lieut.; 1918-20, dist. vocational officer, Hamilton dist. dept. of S.C.R.; 1920-23, asst. to director of tech. education, Dept. of Labour; 1923 to date, Director of Tech. Education.

References: L. W. Gill, H. E. T. Haultain, F. C. C. Lynch, F. S. Rutherford, N. E. D. Sheppard, A. Frigon, N. F. Parkinson.

HAY—MARSHALL NEIL, of Toronto, Ont., Born at Listowel, Ont., May 4th, 1894; Educ., B.Sc., Queen's Univ., 1923; 1913-14, G.T.R. shops, Stratford, Ont., 1920-21, service and sales work with Willys Overland, Ltd., Toronto; 1923 to date, with Aluminum Co. of Canada, as:—mechanical engr. and asst. supt. at Shawinigan Falls; asst. supt. at Massena, N.Y., and asst. supt. at Toronto.

References: H. R. Wake, J. W. Schreiber, C. R. Lindsey, G. Claxton, H. Dessaulles, L. M. Arkley.

HOLDER—GEORGE WILLIAM, of Sault Ste. Marie, Ont., Born at Ottawa, June 6th, 1893; Educ., one yr. applied science, McGill Univ. with class of 1915; 1912-17, asst. engr., P.W. Dept. i/c hbr. survey parties, dredging, etc., dfting plans for parliamentary reports, etc.; 1917-18, dftsman, instrumentman and for 3 mos. res. engr., J. O. Heyworth power house and compensating dam, Sault Ste. Marie.; Jan. and Feb. 1919, instrumentman and general checking calculator constrn. with Fraser Brace & Co., remainder of 1919 with G. L. Ramsey on land survey work; 1920 to date, field engr. for storage development surveys, dam site examinations, etc.; winters from 1923 spent in office on design plans, specifications for concrete dams; summers in the field i/c dam constrn. for Spanish River Pulp Mills hydraulic dept., concrete dams at Pogamasing lake, etc.; at present, superintending constrn. of concrete dams outlet of Red Cedar lake.

References: G. H. Kohl, J. L. Lang, C. H. E. Rounthwaite, C. H. Speer, W. J. Fuller, F. Smallwood, W. S. Wilson.

MOODY—FREDERICK HAYWARD, of Toronto, Ont., Born at Kingston, Ont., May 31st, 1887; Educ., B.A.Sc., Univ. of Toronto, 1909; 1909-10, demonstrator, thermodynamics, U. of T.; 1910, assoc. editor, Canadian Machinery and Power House, Toronto; 1910-11, assoc. editor, Machinery, New York; 1911-15, engrg. editor, Can. Ry. and Marine World, Toronto; 1915-19, capt. and major, 116th Bn. C.E.F.; 1919-20, engr., McLaughlin Motor Car Co., Ltd., Oshawa; 1920-21, sec.-treas., Powley and Moody, Ltd., sales engrs., Toronto; 1921 to date, pres. and man. director, Canadian Electrical Equipment Co., Ltd. (name changed to F. H. Moody, Limited, Jan. 1st, 1927).

References: R. N. Norris, R. W. Angus, R. J. Marshall, C. R. Young, H. C. Barber, W. B. Redfern.

PERCIVAL—GEORGE FREDERICK, of Montreal, Que., Born at Montreal, Que., June 22nd, 1894; Educ., high school; Apl. to Dec. 1911, chainman, Boston & Maine Ry.; Nov. 1912-Jan. 1915, rodman, C.P.R.; 1917-19, overseas with 4th Can. Rly. Troops.; Apr. to Sept. 1919, instrumentman sergt. i/c survey section, C.P.R.; Sept. to Dec. 1919, M. McLennan & Magwood & Stidwell, of Cornwall, Ont., surveys for farm drainage; Jan. to Oct. 1920, asst. engr., G.T.R.; 1920 to date, asst. engr., dept. of tech. service, city of Montreal, general municipal surveys and constrn. work.

References: G. R. MacLeod, J. G. Caron, J. F. Brett, W. T. Jamieson, L. Laferme, E. J. Bolger

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

BEAM—DONALD CARLETON, of St Tite des Caps, Que., Born at Stevensville, Ont., Aug. 21st, 1899; Educ., 4 yrs. at Univ. of Toronto; May to Oct. 1923, foreman on constrn. with J. W. Cawper Constrn. Co., Buffalo, N.Y.; July to Oct. 1924, laying out in shops of Jones & Laughlin Steel Corp., Pittsburgh, Pa.; May to Oct. 1925, engrs. asst. on general mining work, Castle Trethway, Ltd., Gowganda, Ont.; June 1926 to date, i/c field party for Shawinigan Engrg. Co. in connection with Seven Falls-Murray Bay transmission line, Quebec-Isle Maligne transmission line and preliminary work for development of the lower Ste. Anne river.

References: C. H. Mitchell, T. R. Loudon, C. R. Lindsey, C. R. Young, P. Gillespie, H. E. T. Haultain.

BELANGER—RAPHAEL, of Valleyfield, Que., Born at Valleyfield, May 25th, 1899; Educ., B.Sc., C.E., Ecole Polytechnique, 1923; 1922-26, i/c of design and constrn. of reinforced concrete stadium for Valleyfield Exhibition Co., extensions to schools for Catholic School Commissioners, convent (steel structure), semi-fireproof bakery, etc.; at present, city engr., Valleyfield, Que.

References: F. C. Laberge, deG. Beaubien, A. Frigon, T. J. Lafreniere, C. Leluau.

BRADFIELD—JOHN ROSS, of Noranda, Que., Born at Morrisburg, Ont., April 5th, 1899; Educ., B.Sc., McGill Univ., 1922; 1923-24, plant engr., Acme Cement Co.; 1924-26, engr. with Buck & Sheldon, Hartford, Conn.; 1926 to date, asst. to ch. engr., Horne Copper Corp.

References: C. H. Mathewson, E. W. Neelands.

BUSS—JOHN, of Rock City Falls, N.Y., Born at Kalamazoo, Mich., Feb. 14th, 1899; Educ., B.Sc., Queen's Univ., 1919; M.Sc., M.I.T., 1926; 1919-21, ch. chemist i/c lab. Ha Ha Bay Sulphite Co., Port Alfred, Que.; 1921-24, ch. chemist, Bogalusa Paper Co., Bogalusa, Louisiana; instructor M.I.T. 6 mos. during 1926 as asst. director, school of chem. engrg.; at present, res. mgr., Kaydeross Paper Co., Rock City Falls, N.Y.

References: D. M. Jemmett, A. R. Whittier, V. W. MacIsaac.

CAMPBELL—ALEXANDER, of Winnipeg, Born at Aberdeenshire, Scotland, Nov. 26th, 1894; Educ., B.Sc. 1924, M.Sc. 1926, McGill Univ.; 1908-12, apptce. in shops; 1913-16, structural dftsman, Vulcan Iron Works, Wpg.; 1917, C.E.F. Engrs., attached Air Ministry, aerodrome constrn.; 1919-22, student, Manitoba Univ.; 1925-26, lecturer and demonstrator, civil engrg. dept., McGill Univ.; 1926 to date, asst. engr., Dom. Bridge Co., Winnipeg.

References: H. M. White, H. M. MacKay, R. de L. French, E. Brown, R. E. Jamieson, W. Walkden.

CRAWFORD—JAMES JACKSON, of Kenogami, Que., Born at Toronto, Ont., Dec. 10th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1922; 4 mos. experimental plant, Allied Chemical Co., Toronto; 8 mos. inspection engr., asphalt roads, drains, curbs, etc., for Toronto & Yorks Roads Commission; 6 mos. research in cement and concrete, field inspection, on Chippawa Power Canal and Canada Cement Co. of Port Colborne for H.E.P.C.; one year and a half on teaching staff of engrg. faculty, Univ. of Toronto; two mos. special lab. work for Anaconda Am. Brass Co.; 2 yrs. i/c Industrial Labs., Ltd., Toronto; 2 yrs. and at present, asst. to head of tech. dept., Price Bros. & Co., Ltd., Kenogami, Que., i/c chemical lab. work and pulp testing lab. and all testers in mill on control work in mfg. newsprint.

References: C. R. Young, R. B. Young, T. L. Crossley, W. G. Mitchell, A. A. McDiarmid, N. D. Paine.

DECHENE—THEO. MIVILLE, of Quebec, Que., Born at Quebec, Jan. 26th, 1900; Educ., B.Sc., Ecole Polytechnique, May 27th, 1927; 1922 (summer), forestry survey for Service Forestier de la Prov. Que. topography; 1924 (summer), office work for the same; 1926 (summer), office work, Hydraulic Service.

References: A. Frigon, T. J. Lafreniere, A. B. Normandin, L. Beaudry, H. Cimon, A. Duperron, J. A. Lalonde.

DOBSON—ARTHUR LEA, of Scotts Bluff, Neb., Born at New Glasgow, N.S., March 23rd, 1899; Educ., B.Sc., N.S. Tech. Coll., 1922; previous to 1922 during vacations, electrical repair man and machine operator for N.S. Steel & Coal Co.; 1922-23, asst. to constrn. engr., Mar. Teleg. & Tel. Co., Halifax; 1923-24, student engr., Stone & Webster, Boston, Mass.; 1924-25, asst. to mgr., Paducah Electric Co., Paducah, Ky.; 1925-26, asst. to dist. mgr., Western United Gas & Electric Co., Murphysboro, Ill.; 1926-27, office engr., Gulf States Utilities Co., Beaumont, Texas, on design, location & constrn. of high voltage outdoor substations; June 1st, 1927, to date, dist. sales mgr. of Missouri and Eastern Nebraska properties under executive management of Stone & Webster Inc. i/c of all sales in these properties.

References: F. R. Faulkner, F. A. Bowman, W. F. McKnight, D. W. Munn, J. F. Lumsden, J. B. Hayes, K. L. Dawson.

DORMER—WILLIAM JOHN SMYLIE, of Verdun, Que., Born at Middlesborough, England, Dec. 2nd, 1899; Educ., B.Sc., McGill Univ., 1923; 1920 (summer)), Southern Canada Power Co., power line mtce. crew; 1921 (summer) city of Sherbrooke electricity dept., asst. operator; 1922 (summer, city of Sherbrooke electricity dept., system operator; 1923 to date, Bell Telephone Co. of Canada, eastern div., foreign wire relation dept., investigating interference in telephone circuits caused by paralleling power systems and supervising the placing of remedial measures.

References: J. L. Clarke, G. M. Hudson, H. E. Pawson, G. A. Wallace, C. V. Christie, G. L. Bockus, A. Lariviere.

GIBBS—CHARLES RICHARD, of Carthage, N.Y., Born at Carthage, N.Y., Jan. 27th, 1893; Educ., B.Sc., McGill Univ., 1916; with Ryther and Pringle Co., Carthage, from 1916 to date, as follows:—1916-19, machine shop foreman; 1919-22, superintendent; 1922-26, engineer; 1926 to date, engr. sales and plant mgr.

References: J. E. A. Warner, P. A. Trost, H. V. Haight, S. R. Newton, E. S. Winslow.

GRIESBACH—ROBERT JAMES, of Maniwaki, Que., Born at Collingwood, Ont., Oct. 4th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1924; 1921, labour at Hollinger Gold Mines and two mos. prospecting in Rouyn; 1922, inspector for Ont. Dept. of Highways; 1923, machinist's helper for Yonge Bros., Detroit; 1924, asst. to res. engr., Foundation Co. of Canada, at Hemmings Falls power development; 1925, resident engr. for same company on extension to Wayagamack Pulp and Paper Co.; 1925 to date, res. engr. for Foundation Co. on constrn. of Bitobee storage dam on Gatineau river.

References: R. E. Chadwick, L. C. Jacobs, T. A. Barnett, C. R. Young.

HUBBARD—EDWARD B., of San Diego, Calif., Born at Mexico City, Apr. 6th, 1899; Educ., B.A.Sc., Univ. of Toronto, 1925; 1914-15, apptce. dftsman, Map Specialty Co., Toronto; 1915-17, jr. mech. dftsman, Toronto Power Co.; 1919-21, dfting, detailing, computing for hydraulic dept. H.E.P.C.; May to Sept. 1922, under supervision designed preliminary layout of rock crushing and concrete mixing plant for Can. & General Finance Co., Toronto; May to Aug. 1923, dfting, detailing, computing, H.E.P.C.; May to Sept. 1924, assisted in work on flow studies of Spray and Ottawa rivers; May to Sept. 1926, conducted flow storage studies of Ottawa, Kaministiquia, Muskoka and Nipigon rivers, conducted enquiry of feasibility of diversion of Ogoki river for H.E.P.C.; Nov. to Dec. 1926, dftsman, Watson, Nalle & Gough Inc., San Diego; Jan. 1927 to date, structural engr. for same company on design of culverts, highway bridges, retaining walls, etc.

References: T. H. Hogg, O. Holden, J. A. Knight, C. C. McLennan, T. R. Loudon, R. L. Hearn.

MacQUARRIE—EDISON MALCOLM, of Sault Ste. Marie, Ont., Born at Sault Ste. Marie, Dec. 7th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1924, O.L.S. 1925; 1911 (summer), rodman and chainman with Lang and Ross; 1912-14, with Lang and Ross as dftsman and instrumentman; 1914-15, with Fivay Land Co. of Fivay, Fla., engr. i/c laying out townsite; 1915-17, with Lang & Ross during summers as instrumentman i/c party on Georgian Bay island survey, winters, dfting; Apl. to July 1917, with Chester Shipbldg. Co., Chester, Pa., asst. to field engr. on constrn. and mtce.; 1917-19, overseas as sapper with 3rd Can. Engrs.; 1919-20, Lang & Ross, road location and flooded area; 1920-24, at Univ. of Toronto, 2 summers with Lang & Ross as transitman, 1 summer with G. L. Ramsay i/c office and city surveys; 1924-26, Lang & Ross, transitman; 1926-27, with Spanish River Pulp & Paper Co. at Sault Ste. Marie and Sturgeon Falls as designer on mill changes and new installations; Jan. to June 1927, Lang & Ross, i/c flooded area survey; at present, private practice.

References: J. L. Lang, K. G. Ross, G. H. Kohl, C. H. E. Rounthwaite, W. B. Crombie, J. D. Jones, A. E. Pickering, W. J. Fuller.

MAXWELL—EDWARD GERRARD, of Ford City, Pa., Born at Halifax, N.S., Apr. 8th, 1897; Educ., B.Sc. (C.E.), McGill Univ., 1924, B.Sc. (Arts), Dalhousie Univ., 1922; 1924-25, cost accounting work, Bell Tel. Co., Mtl.; 1925-26, production dept., Northern Electric Co., Mtl.; July 1926 to July 1927, with Packard Motor Co., Detroit, as follows:—July to Oct. 1926, handyman in shop; Oct. to Dec., in production control office, calculating economical quantities of parts to be run in shop; Dec. 1926 to July 1927, i/c engrg. alterations in product as they affect the production dept.; July 1st, 1927, to date, efficiency engr. at Ford City plant of Pittsburgh Plate Glass Co.

References: H. M. MacKay, W. P. Copp, H. W. L. Doane, R. A. Spencer, E. C. Little, E. Brown.

McDERMID—GEORGE, of Winnipeg, Man., Born at Indian Head, Sask., May 18th, 1900; Educ., B.Sc., Univ. of Manitoba, 1927; 1925 (summer), municipal work, city West Palm Beach; 1926 (summer), instructor's course, Royal Can. Corps of Signals, Camp Borden; at present, city sales, Western Steel Products, Ltd., i/c sale of bldg. materials and insulating problems.

References: E. P. Fetherstonhaugh, R. W. Moffatt, J. N. Finlayson, N. M. Hall, G. H. Herriot, J. Quail.

McDOUGALL—STEWART ROBERTSON, of Montreal, Que., Born at New Westminster, B.C., Apr. 10th, 1900; Educ., B.Sc., 1922, M.Sc., 1923, Univ. of B.C.; 1923-24, post grad. research at Univ. of B.C.; 1924-25, one yr. at McGill Univ.; 1917 (summer), machinist's helper, Heaps Engrg. Works, New Westminster, B.C.; 1919 (summer), papermaker's helper, Power River Co.; 1920 (summer), boilermaker's helper, Coughlan Ship Yards, Vancouver; 1918 and 1921 (summers), dry kiln attendant, Brunette Saw Mills, New Westminster, B.C.; 1922 (summer), asst. finisher, concrete road constrn., Cotton Co., Vancouver; 1922-23, instructor in advanced analytical chemistry, Univ. of B.C.; 1923-24, Dom. Research Council bursary at Univ. of B.C.; 1924-25, Dom. Research Council studentship at McGill Univ.; 1925 to date, chemical engr. on tech. staff, engaged in mfg. problems and plant control, Northern Electric Co., Montreal.

References: W. H. Eastlake, N. L. Morgan, W. H. Powell, J. D. Hathaway, R. W. Brock.

McQUEEN—ANDREW WILLIAM FRASER, of Niagara Falls, Ont., Born at Lowestoft, England, Feb. 7th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1923; 1923-27, asst. to engr. of tests, H.E.P.C.; at present, with H. G. Acres & Co., hydraulic and general engineering computations and investigations.

References: R. L. Hearn, J. J. Traill, J. A. Aeberli, R. W. Angus, O. Holden, S. W. B. Black. J. A. Knight.

MENZIES—JOHN ROSS, of Brantford, Ont., Born near Gorrie, Ont., July 17th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1926; June 1925, subdivision work with R. M. Lee, Brantford; July, Aug. and Sept. 1925, asst. and instrumentman on Geological Survey of Canada; May to June 1926, with A. M. Jackson, county engr., Brant Co., as asst.; June 1926 to date, with Sutcliffe Co., Ltd., New Liskeard, Ont., as instrumentman on lake and river traverse, twp. surveys, power reserve and subdivision surveys, mining claim surveys and preliminary waterworks survey, i/c of party during most of this period.

References: T. R. Loudon, P. Gillespie, A. M. Jackson, H. W. Sutcliffe, T. S. Armstrong.

MUNRO—DAVID JOHN BEST, of Quebec, Que., Born at Inverness, Scotland, Mch. 9th, 1900; Educ., B.Sc., McGill Univ., 1923; 1919 (summer), dftsman, C.P.R.; 1920 (summer), electrician's helper, C.P.R.; 1921 and 22 (summers), records man, G. M. Gest, Ltd.; 1921 (summer), plumbing inspector, Thompson-Starrett Co.; 1923-27, railway equipment engr., Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.; at present, asst. to mech'l supt., Quebec Ry. Light & Power Co.

References: C. V. Christie, E. Brown, G. A. Wallace, P. S. Gregory, C. M. McKergow.

PLUMMER—WILLIAM ELFRIC, of Humberstone, Ont., Born at Stratford, Ont., June 21st, 1889; Educ., I.C.S. course concrete engrg.; 1907-08, inspector and timekeeper with the Peter Conely Constrn. Co.; 1908-12, Lake Superior Corp. as timekeeper; 1912-13, rodman and inspector, Algoma Central Railway; 1913-15, instrumentman, Welland Ship Canal; 1915-16, asst. engr., Welland Ship Canal; 1916-17, service in England and France with Can. Engrs.; 1919-27, asst. engr. with Welland Ship Canal.

References: A. J. Grant, E. G. Cameron, F. E. Sterns, G. Kydd, E. C. Jewett, J. B. McAndrew, A. W. L. Butler.

PRINGLE—GEORGE HUGH, of Chillicothe, Ohio, Born at Pictou, N.S., July 1st, 1903; Educ., B.Sc., McGill Univ., 1926; 1923 (summer) and 1924 (summer), employed by Can. Iron Foundries on machine shop work; 1925 (summer), with Int. Paper Co. on engrg. staff doing layout work, etc.; Sept. 1926 to May 1927, on engrg. staff of Can. Paper Co., Windsor Mills, drawing up plans for installation of equipment in new beater room, machine room and bleach plant; at present, on engrg. staff of Mead Pulp & Paper Co. on mtce. and extensions under direct supervision of the ch. engr.

References: H. M. MacKay, A. R. Roberts, C. M. McKergow, W. P. Copp, G. Niklasson, E. Brown.

RINFRET—GUY RAOUL, of Montreal, Born at Dawson City, June 3rd, 1901; Educ., B.Sc., McGill Univ., 1926; 1918-20, with Shaw. Water & Power Co. as chainman and rodman; 1920 (summer), with Shaw. Engrg. Co., Ltd., as leveller for tower bases on Shaw. Falls-Montreal transmission line; 1920-21, June to Sept. 1922, May 1923 and June to Sept. 1923, instrumentman with Shaw. Engrg. Co. and Quebec Streams Commission; May to Oct. 1924, with Shaw. Engrg. Co. as instrumentman i/c field work on constrn. of reinforced concrete viaduct; June to Aug. 1925, instrumentman on transmission line location in vicinity Shaw. Falls and Three Rivers; Sept. 1925, i/c survey party at St. Alban, Que.; May to Aug. 1926, with Shaw. Water & Power Co. on surveys, estimates, etc., at Shaw. Falls; Sept. 1926 to date, with Power Engrg. Co., as:—Sept. to Nov. 1926, i/c survey party on Mattawin river; Dec. 1926 to Mch. 1927, on office work relative to above survey; at present, on power development estimating.

References: S. S. Svenningson, C. R. Lindsey, H. Dessaulles, O. O. Lefebvre, H. M. MacKay, E. Brown.

SMART—GEORGE WALLACE, of Toronto, Ont., Born at Port Hope, Ont., July 16th, 1899; Educ., B.A.Sc., Univ. of Toronto, 1926; 1921, surveying with York Twp. engrs., Barber, Wynne-Roberts and Seymour; 1922 and 25, instrumentman, City Roadways Dept.; 1926-27, radio engr., Splitdorf Electric Co.; at present, electrical engrg. research asst. strength lab., Univ. of Toronto.

References: T. R. Loudon, C. H. Mitchell, P. Gillespie, C. R. Young, J. R. Cockburn.

SPRATT—MAYNARD JAMES, of Port Arthur, Ont., Born at Ottawa, Ont., Oct. 26th, 1899; Educ., B.Sc., McGill Univ., 1922; 1920, road engr., Carleton County, Ont.; 1921 (season), Geodetic Survey, instrumentman; 1922 (season), Dom. Land Survey, articled pupil; 1922 to date, with C. D. Howe & Co., as follows:—1922-23, dftsman on plans for Bawlf elevator; March 1923, inspector of pile driving, Bawlf elevator, later, inspector of constrn. to completion of job.; 1924 (season), loaned to Carter-Halls-Aldinger Co. as reinforcing engr. on Govt. elevator; 1924-26, supervising constrn. of Sask. Co-Operative elevator at Buffalo, N.Y.; May 1926, loaned to Bennett and White Constrn. Co. as reinforcing and bolt setting designer; Jan. 1927, returned to C. D. Howe as designer on Burrard elevator at Vancouver; March 1927, to Bennett & White as estimator and designer of various works; at present, with C. D. Howe & Co. as designing engr.

References: H. M. MacKay, C. D. Howe, W. H. Souba, R. B. Chandler, G. H. Burbridge, G. P. Brophy, M. W. Jennings, M. B. MacRostie.

TITUS—ERNEST MOULTON, of Saskatoon, Sask., Born at Lynn, Mass., May 4th, 1900; Educ., B.E. and M.E., Univ. of Sask, 1925 and 1927; 1921 (summer), rodman, C.N.R.; 1923 (summer), asst., Geological Survey, Dom. Govt.; 1924 (summer), instrumentman, Dept. of Highways, Sask.; 1925 and 26 (summers), engrg. dept., Univ. of Sask.; winters of 1925-26 and 1926-27, part time in material lab. testing materials and instructing at Univ. of Sask.; at present, supt., A. W. Heis & Co., Ltd., contractors, Saskatoon.

References: C. J. Mackenzie, G. M. Williams, A. R. Greig, H. R. MacKenzie, A. A. Spencer.

WARKENTIN—CORNELIUS PAUL, of Winnipeg, Born at Winkler, Man., Nov. 25th, 1898; Educ., B.Sc., Univ. of Man., 1926; at present, dfting and general office work in the bridge dept. of the Good Roads Board, Prov. of Man.

References: M. A. Lyons, W. E. M. James, J. N. Finlayson, E. P. Fetherstonhaugh, N. M. Hall.

WHITTEMORE—CARL RAYMOND, of Trail, B.C., Born at Liverpool, N.S., Nov. 15th, 1899; Educ., M.Sc., McGill Univ., 1924; 1924, research chemist, McArthur Irwin Paint Co., Montreal; 1925, experimental work in ore dressing, Cons. Mining and Smelting Co., Trail, B.C.; 1926 to date, i/c tech. service dept., Cons. Mining and Smelting Co., Trail, B.C.

References: A. Stansfield, G. St. G. Sproule, G. P. Cole, A. B. Ritchie, F. S. Keith, E. Brown.

WILFORD—JOHN RICHARD, of Lindsay, Ont., Born at Iroquois, Ont., Nov. 29th, 1898; Educ., 1919-22, S.P.S., Toronto, passed exams. of 1st and 2nd yrs. mech'l engrg.; 1917-19, overseas with R.N.A.S.; 1919-20-21 and 22 (summers), timekeeper and assisting in superintendence of constrn. of Lakefield and Young's Point dams on Trent Canal; May 1924 to date, employed by F. R. Wilford & Co., Ltd., in executive position as engr. and supt. on design and constrn. of bldg. jobs, also estimating, etc., on all phases of contracting, including roadwork, concrete work, general bldg., etc.

References: F. R. Wilford, A. L. Killaly, R. H. Parsons, A. Munro, E. L. Miles, C. H. Mitchell.

WRIGHT—JOSEPH AGAR, of Winnipeg, Man., Born at Newry, Ireland, Oct. 2nd, 1894; Educ., undergraduate, Univ. of Man.; 1913-15, with G.T.P. as chainman and rodman; 1915-19, service with C.E.F., demobilized as lieut.; 1923, levelman, 1924, topographer, and 1925 to 1926, instrumentman with C.N.R.; at present, instrumentman on Hudson Bay Ry.

References: C. E. Dunn, J. G. MacLachlan, H. A. Dixon, R. W. Ross, D. V. Hope, I. C. Main, A. J. Gayfer.

WYLDE—CHARLES NAPIER, of Dryden, Ont., Born at Montreal, Nov. 13th, 1898; Educ., B.Sc., McGill Univ., 1923; grad. of Royal Military College, Sandhurst, England, 1917; 1923 (2 mos.), helper in paper mill, Wayagamack Pulp & Paper Co.; 1915-26, with Charles Walmsley & Co., shop work and dfting office and i/c steam plant and electrical equipment; Sept. 1926 to May 1927, i/c mill mtce. and new constrn. work, Dryden Paper Co., Ltd.; June 1927, ch. engr., Dryden Paper Co., Ltd.

References: J. S. Wilson, A. R. Roberts, C. M. McKergow, K. S. LeBaron, E. Brown.

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The Scientific Method in Industry

Its Necessity at the Present Time and Some Examples of Its Application

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Paper read before the Montreal Branch of The Engineering Institute of Canada, March 3rd, 1927

Few will now dispute the fact that, with very few exceptions, it is much more expensive to manufacture in Canada than in the United States, due largely to the high cost of materials and fuels, to say nothing of the increased cost due to the smaller market that we have in this country as compared with our neighbour to the south.

If at this late date proof of this fact is still desired, a glance at the following table of comparison of material, fuel and labour costs for Montreal district and central Georgia, where, we understand, the "New South" is coming into its own, will be convincing:—

	Central Georgia, U.S.A.	Montreal, Canada
Common building brick, per thousand	$11.00 to $14.00	$18.00
Cement, per barrel	3.00	1.37 (net)
Crushed stone, per ton	1.25 to 1.65	1.65 to $ 1.75
Lumber, per 1,000 feet	24.00 to 60.00	35.00 to 80.00
Coal, per ton	3.50 to 4.50	9.00
Fuel oil, per imperial gallon	003.6 to 004.2	0.118
Hydro-electric power, horse power per annum (1,000 h.p. installation, 24-hour service)	32.00	36.00 to 40.00
Common labour, per hour	0.20 to 0.40	0.30 to 0.40

Practically everything, therefore, costs more in Montreal with the exception of cement.

Distant pastures may look green, and some may envy the lot of the manufacturer in the United States, but, as stated above, they, too, have their problems, and it is far from the writer's intention to say anything that might tend to increase what has come to be known as the exodus to the south.

How, therefore, can industry in general in Canada compete in the world's market and have nothing to fear from tariff investigators? Only by more efficient management and by a better realization and appreciation of what scientific methods can accomplish in every-day manufacturing problems; and this applies to the business side of engineering and marketing as well as to the purely technical phases. This is simply another way of stating that facts must be known. Facts should govern every industry, so as not to work ahead blindly; for it is by visualizing facts and meeting economic conditions that individuals or firms progress.

Much has been written in recent years of the value of scientific industrial research on a large scale and the economic returns that follow its adoption. In fact, it has been stated that science is now advancing at a rate so rapid and with results of such far-reaching influence that no industry can hope to ignore research and survive. However, it is not proposed in this paper to cover the broad field of industrial research or to appeal to the large industrial organizations that maintain extensive research laboratories of their own, but simply to touch on a few points of contact between science and industry and to point out where the smaller industry or every day run of manufacturer may perhaps benefit by scientific aids and methods that are available to everyone.

In the first place, there is an urgent need for technical control and more efficient management in the ordinary run of our industries. True, some of our industries, such as the pulp and paper, varnish and the sugar industries, are already entirely under technical control, and in these no major decisions are taken without technical advice. However, there are many industries where little or no technical advice is sought. Nearly everyone can recall some instances in the past where decisions involving heavy expenditures have been made with only the most meagre information at hand. In other words, there has been a large economic waste in the past due to lack of technical advice.

It was a surprise to many people to learn from the report published in 1921 by the Committee on Elimination of Waste in Industry, carried out by the Federated American Engineering Societies, that over 50 per cent of the responsibility for these wastes in the six leading industries studied was placed at the door of management and less than 25 per cent at the door of labour; while the amount chargeable to outside contacts, (the public, trade relationships and other factors), least of all.

No one who had the privilege of hearing Mr. J. B. Phillips' paper before this Institute last fall on " Manufacture of Kraft Pulp " could fail to be impressed with what an important part chemical control plays in this industry. In fact, it would be ridiculous to think of trying to operate such an industry without a chemist. For any industry to take advantage of scientific methods as a means to more efficient management, the only assumption necessary is that there must be someone in the organization possessing a scientific attitude of mind with a mania for investigations and digging up the facts.

It does not follow that such an individual must be an engineer, as many of the problems met with are business problems, but it is particularly important that such an individual possess a scientific attitude of mind, and this is largely the result of his education and training. There is no doubt the man with an engineering training is exceptionally well equipped to solve business problems, particularly if he is good at diagnosis. The scientific attitude enables him to approach a problem entirely without prejudice, intent only on finding out the true facts, with a willingness to accept the truth when found, even though it may be distasteful or not in agreement with his personal opinions.

Science operates in the development of an industry in a two-fold manner. The scientific worker may utilize scientific knowledge or he may apply the scientific method to the every day problems which present themselves. There are many small manufacturers producing articles of commerce that utilize science without being aware of the fact. They unknowingly profit by the scientific researches of others that have gone before, in much the same way as the small contractor who employs I-beams in his buildings without knowing the reason for their special form. He may know nothing about moments of inertia, and when coming to decisions on his dimensions he will refer to the structural shape handbook wherein men of science have made for him every necessary calculation. Similarly, many will make scientific measurements by means of pyrometer equipment, graphic recording meters, flow meters, etc., without realizing the application of science in the development of their instruments. No industry can exist nowadays without leaning in some way or another on science.

However, the scientific method means more than simply to be well informed on scientific subjects. It is capable of quite useful and practical application. Let us here review the essential principles which form the basis of scientific method; that is to say, those rules which must be followed in order to ascertain facts in the most certain, rapid and economical way.

The first operation of the method consists in the subdivision of each object into its most simple constituents. The supreme importance of this division is accounted for in the weakness of our brain, incapable of conceiving anything of a complex nature. This operation carried out, we are enabled to appreciate with greater ease facts which are the more readily perceived as the object becomes simplified. This was one of the points on which Descartes laid so much stress in his " Treatise on Method."

There are many different ways of subdividing an object, which may be varied according to its nature. In a general way, the tendency must be to separate those parts least resembling one another, and to allow the more closely allied quantities to remain together. For the moment, the chemical elements are the limit of our subdivision.

It is not always necessary to go so far in our subdivision as the chemical elements; one can generally stop before that. Nevertheless, one should get down to measurable quantities of what are, as far as possible, independent variables, so that at will any one or two of them may be varied without in any way altering the others. This last condition is quite important in many investigations.

All the phenomena of nature are so related that when any change occurs in any one phenomenon it brings with it changes in one or other of its correlated conditions. For example, the volume of a gas cannot be diminished at constant temperature without increasing its pressure. These relationships, or, rather, laws, may be reduced to an algebraic formula, and the exclusive object of science is to find and become acquainted with these laws and to find formulæ to serve them.

These laws are unequally complicated. Those of pure science, where every change in a material is ignored save one, (that which, at the time, is being studied), are the most simple. In industrial science, however, one finds laws of a much greater complexity, and these are more difficult as they are less wide in their application. In factories, it is necessary to take into account every variable in the properties of a material. None of these may be neglected, even in dealing with a function having as many as a dozen variables in which the number of combinations is almost limitless.

One of the most celebrated of these problems resulted in the formulation of a law by Frederick W. Taylor on the cutting of metals. He gave a factor for the selling cost by weight of the filings or turnings removed in a function of twelve variables; the speed and depth of cut; the extent or area of cut; the angles of the cutting faces; the chemical composition; the annealing temperature, and the back thrust of the tool; the price or cost of the metal worked; the robustness of the machine, etc. It was the establishment of this law that assisted in the revolution of machine shop practice and mechanical construction.

It is now possible to deal with that method whereby the scientific worker in the factory or the investigation executive may gather together and deal most economically with those problems which confront him daily. In order to study the problem, let us endeavour to apply the principle of division outlined above. The fundamental steps involved in the investigation of any problem may be divided as follows:—

1. Belief in the necessity for natural laws, so-called doctrine of " determinism."
2. Analyzing the problem in order to find out what is wanted; in other words, fixing the end to be obtained.
3. Study of means to be employed for the attainment of that end.
4. Getting together and preparing the means found to be necessary and collecting the facts bearing on the problem.
5. Carrying out the experiments and studies projected.
6. Discussion of the results; control of their accuracy; utilization of the facts obtained.

Determinism

Determinism has been defined as the doctrine that whatever is or happens is entirely determined by antecedent causes. The belief in the necessity of laws is the foundation of all science. It is useless to talk of scientific method if one does not believe in the permanence and applicability of the relationships on which natural phenomena are mutually hinged. Theoretically, everyone will admit this point, but in factories it is not an uncommon thing to find people whose attitude to their problems might lead one to think that they did not believe in these laws, for they admit the intervention of chance. A process of manufacture is repeated a second time but does not give the same result,—no one is astonished. These irregularities bring with them losses which are accepted as inevitable, and that is the very opposite of the scientific spirit. There is no effect without a cause. If results change from one operation to another, then one of the determining conditions must have been modified. They have been allowed to change without noticing the fact. Thus only can chance occur.

Another example frequently met with runs about as follows:—A new source of supply for a material used in a manufacturing process becomes available. The physical condition and chemical composition as determined by several analyses of the new material indicate that it can be safely substituted for the old material. The new product is introduced and shortly after something goes wrong. Naturally, the new material is blamed for the resulting trouble, although in the majority of instances operating methods or other factors are responsible for the changed conditions. It therefore requires an open mind and a knowledge of all factors bearing on the problem to prevent condemning the new material at the very outset. If, after investigation, you are thoroughly convinced the new material is not at fault it can frequently be tried out at another plant and after a considerable period of operation be introduced in the original factory with complete success.

Occasionally changes, inappreciable to our limited means of observation, may have a considerable influence on the desired results, as for instance, the presence of dissolved oxygen in metals, but much more often it is only our negligence that is responsible for these modifications, which have crept in unperceived. It is the active belief in determinism that urges us to look for the cause of all anomalies, and nearly always it enables us to discover the unknown variable.

Fixing the End to be Attained

The first step in the study of any problem is a careful analysis, the purpose of which is three fold; (a) defining the problem, (b) determining the objective, and (c) devising working hypotheses.

Le Chatelier has shown* that it is always essential to have an objective, single, precise and of small magnitude. He states there must be only one single objective, the end must be precise, and for this it is essential that the end sought for should be a measurable quantity, also the end should be as restricted as possible. In other words, any subject tackled must be divided into its constituent parts and a second not tackled until the first has been thoroughly completed. It was in this way that Taylor worked in his experiments on the cutting of metals. First he studied the influence of speed on the nature of the cut without in any way modifying his tools; then he studied their shape, and finally he tackled the problems of chemical composition and of heat treatment.

* Jour. Soc. Glass Tech., vol. vii, p. 283, Dec. 1923.

Studying the Means to be Employed and Collecting the Facts

With the situation analyzed, the end defined, and certain working hypotheses outlined, the next step in the solution of any problem is the collection of facts to prove or disprove and to develop these hypotheses. Take the problem of reducing manufacturing costs. The objective may be that of increasing individual production and the *working hypothesis,* or possible solution may be a *production bonus.* But are conditions such as to make it possible for the workers consistently to increase their output? Without collecting information on these and other points, any attempt to devise a wage-incentive plan would be folly.

So it is in other fields. What manufacturer can hope successfully to advertise and sell his product if he does not know the facts as to the real field for the product; the character, number, and location of potential users; the buying appeals that interest the market, and so on? All of this information can be secured only through painstaking research.

Carrying Out of the Experiment or Studies Projected

When once the programme of research, investigation or study has been arranged, and all necessary material prepared, the next step is the carrying out of the work. It is at this point that the investigator will have to decide how much of the work can be left to unskilled hands or whether he must himself do the details. This will depend on the nature of the investigation. In many cases it will be found in the long run to be most economical and advisable to do the work himself, as he knows just what is required. This is the stage where an intimate knowledge of the industry and the apparatus connected therewith is essential, and where the investigator will draw on all the experience at his command. Whether the problem is the improvement in a furnace, a metallurgical process or the detailed design of an electrical machine, a study of their design is of the utmost importance, because only by such a study can a knowledge of the limitations of the equipment be acquired.

If the problem under investigation calls for experimental work two essential rules must be followed. First, all the conditions of the experiment must be noted with the greatest care. Certain of these may seem at the moment to be without interest, but later it may be found that on account of the neglect to record certain observations, all the conclusions bearing on the subjects studied cannot be drawn.

A second rule not less essential is to constrain oneself to closely follow the programme laid down in the beginning. It may be the intention to improve it during the course of the investigation, and without further thought the initial programme is abandoned, but before long the work will be carried on, by chance, without method.

Application and Control of Results

The purpose of any investigation or experiment is to discover something, and once the work has been accomplished, a conclusion should be drawn. While the formation of logical conclusions based upon the facts collected may close an investigation of a purely informative character, in the average industrial investigation, however, a further step is demanded, which is the interpretation of these conclusions and the preparation of recommendations showing what the investigator suggests in order to correct the conditions on account of which the investigation was made. The ability to devise new and improved methods, which are at the same time practical, is what should be striven for. To accomplish this the investigator must cultivate a constructive imagination and give constant consideration to the factor of practicability. Every resource of industrial experience must be brought into play.

This, then, is the scientific method of attacking a problem, and there is no reason for any mystery to exist in the mind of any one concerning it. The scientist uses the same thought process as any individual. He observes facts, classifies his observations, makes inferences, and forms conclusions. However, because he has the orderly approach, he observes more critically, classifies more accurately, is surer in his judgments, and draws on wider sources of information for his inferences.

The writer maintains that in the whole field of human endeavour there is no more interesting job than the working through to a logical conclusion any problem or investigation of a subject that one knows little or nothing about at the start, where one is devoid of biased opinions, and where the conclusion or solution is not evident until all the facts are in your possession.

Aside from the technical literature available no matter what industry is under discussion, there are several aids within the reach of every manufacturer that will enable him to scientifically control his product. Foremost of these aids is the chemical and physical laboratory.

The Chemical and Physical Laboratory

Unfortunately, the purity or suitability of many materials that enter into a manufactured product cannot be determined by visual inspection, but must be chemically analyzed or their properties determined by physical tests. Take for example a silica sand which is required with a low iron oxide content. A chemical analysis is absolutely necessary in order to determine the detrimental impurities, and some of the whitest and most promising looking sands turn out to be absolutely worthless.

The physical properties of many materials have a relationship to their chemical composition, and in many chemical laboratories the chemical equipment is being supplemented with special petrographical microscopes, apparatus for X-ray photographs, etc., to enable them to quickly determine all the characteristics of the materials under investigation.

Even where frequent and regular analysis of raw materials are necessary in order to control the finished product, it is not always economical or advisable to possess a private laboratory. Very frequently it will be found more economical in the long run to turn over routine analyses to a reliable firm of consulting chemical engineers, and even when special investigations or studies are required, satisfactory results can frequently be obtained by placing at the disposal of these consultants all available data bearing on the problem, and let them concentrate their efforts to obtain a solution.

Aside from being relieved of the responsibility of operating and supervising a private laboratory, the consulting chemical firm will be in touch with the latest developments in various chemical process industries, and can thus summon to their aid a wealth of experience that the other organization could hardly be expected to possess. There is a very close tie-in of the various chemical process industries, and it is certainly advisable to keep in touch with developments in other industries which might find application in the one of particular interest. While the products manufactured may be entirely different, the unit operations are basically the same. Therefore, any new development, any new method, is just as valuable to those in a different process industry as it is to men who are in the industry in which the development occurred. The contact with an outside firm of consulting chemists helps one to keep up to date in the test developments.

The importance of chemical analysis in present-day manufacture is well illustrated by the following:—At a convention recently attended by the writer, from thirty to forty delegates, not over one-third of them plant chemists, sat through a four-hour highly technical discussion of an outlined method of analyzing a certain product. Six or seven years ago there would have been barely five in attendance, the rest would have considered the matter as of only academic interest.

Use of Indicating and Recording Instruments

One of the greatest aids in scientific management is the increasing use of indicating and recording instruments, and money invested in such instruments is well spent. Where the combustion of fuel is concerned, they are very essential. Without suitable instruments, a manufacturer is asking his men to guess, where he could give them a means of knowing. He is probably wasting fuel, obtaining results which he cannot duplicate, and is certainly without means of checking up on his men and equipment. A suitable recording instrument installed in the manager's office has a very beneficial effect on furnace operation, as the operator realizes that a check on his work is continually in evidence. It is a well-known fact that the Canadian pulp and paper concern that showed the lowest cost of newsprint during the war was the one where every possible application of speed indicators and recording instruments was carried out.

Now automatic temperature control is being increasingly used where the automatic control of fuel valves does away with wasteful hand regulation. Automatic temperature control cuts down labour costs by freeing the operators for more productive work; it saves fuel by constantly regulating the valves, thus eliminating overshooting the mark; it eliminates the necessity for bringing a furnace up to temperature after it has lagged and improves the quality of the product because it keeps the temperature of the furnace at exactly the point of desired setting.

Standard Specifications

The issuing of standard specifications for raw materials is now the practice of many manufacturers. Such specifications no doubt contribute to the production of a better quality finished product, although they do not meet the approval of everyone. In this connection, Dr. John A. Mathews in The Engineering News-Record, charges that there is too much standardization and too little scientific method, or too little real union between science and industry. He states:—

> "I hate to think of the man-hours spent in the last twenty-five years arguing, haggling, disputing and compromising over so-called standard specifications. Being compromises, they are rarely wholly satisfactory to either producer or user, and they rarely represent the highest class material. I dislike intensely manufacturing down to a specification rather than up to an ideal, in order to meet competition and to remain in business."

The writer does not agree with the above statement. He has found standard specifications to be of great help if they are intelligently made out in the first place, with full regard to the limits of impurities that can be tolerated. Such specifications are usually welcomed and found useful by the purchasing department, since with their use they have a comeback on the producer if the product does not come up to specification.

In many instances it is necessary to take whatever raw materials are available, but this does not prevent the revision of the specifications from time to time, as purer sources of supply become available. The manufacturer often has to decide which he will have,—cheapness or quality. In many problems a compromise must be made, although it is realized where quality is the sole consideration, nothing but the best will do.

Simplification and Elimination of Waste

The scientific method can be applied to the simplification of products, resulting in much lowered costs and elimination of waste. Many manufacturers have a great number of designs, styles, models or types of their product. Where a close study has been made of the production and sales, it has been found that there is little demand for some models, while the greatest demand is for very few models. In fact, 80 per cent of the business was done with 20 per cent of the models.

Many industries have increased profits by cutting out a lot of lines and concentrating on those which were found to be in biggest demand. The anti-waste campaign and simplification of products, under the direction of Secretary Herbert Hoover, in the United States is undoubtedly one of the greatest industrial movements in the past twenty years. In the electrical business, one hundred and eighty varieties of lamp bases had been reduced to six. There used to be sixty-six kinds of paving brick, now there are five. There used to be forty-nine kinds of milk bottles, now there are nine. Secretary Hoover made the statement a short time ago that through elimination of waste, industry had made savings to the producer, the distributor and consumer, estimated at over $600,000,000 a year.

Scientific Method Applied to Business and Financial Problems

One of the most interesting phases in recent years is the application of engineering methods of analysis to business and financial investigations. Upon engineers with special economic qualifications rests the whole future structure of sound development in industry. In executive and technical circles one notes increasing appreciation of the place of economics as applied to current and future problems, and during the next few years will be seen an unprecedented development of the scientific method in the conduct of the affairs of industry.

Accurate cost data are becoming of supreme importance to every industry. The problems of cost determination are so difficult that in many organizations only the surface has been scratched. With care, however, a simple and workable cost system can be devised for any industry. Research in selling can become an equally valuable aid in widening the field of consumption. This is exemplified in the growing tendency to recognize the sales and merchandizing type of mind in selecting the executives of our manufacturing organizations.

There is, however, a new note in selling that must be recognized, particularly in those industries that are based on science and engineering. It arises from the fact that never before were the demands of the consumer so refined and so exacting. With the desire and necessity for increased production in his own process have come his demand for higher standards in raw materials, for improved processes and better equipment, and for new materials of construction.

This means that the seller must approach the prospective buyer with some knowledge of the latter's needs, and with constructive help. In many cases it means that the manufacturer must actually research the customer's problem, particularly if a new and improved product is involved. From now on it will be found that an increasing number of manufacturers are committed to a policy of research or investigation in both production and distribution. As the editor of *Chemical and Metallurgical Engineering* puts it:—" Evidently industrial research is a two-edged tool, applicable on one side to improved production and on the other to increased consumption. The manufacturer that fails to apply it in both directions is using it at only 50 per cent efficiency."

Scientific methods in distribution are recognized when it is seen that firms of only moderate size include a traffic department or routing department in their organization. The president of a moderate sized bottle plant in the United States casually mentioned to the writer that a short time before he had found it necessary to take on a " routing clerk " at $6,000 per annum. The duties of this individual were to arrange for routing incoming and outgoing shipments, and he had nothing whatever to do with the planning or routing of material in their own factories.

Making Use of Government Agencies and Reports

There are numerous sources of specialized data available to all which might be used to much greater advantage. They are useful not only to those charged with the responsibility of investing capital in industrial enterprises, but also to the industries themselves. Some of these sources of information are the Department of the Interior, with its various branches; the Department of Trade and Commerce, with its well-organized Commercial Intelligence Branch; the banks and the railway corporations; the Commercial Intelligence Department of the Canadian Manufacturers' Association; reports of the Department of Mines and the Geological Survey at Ottawa; and publications of the various provincial governments. Prof. R. R. Thompson, professor of accountancy at McGill University, called attention to this matter last fall in the following words:—

> " Many Canadian business men take advantage of these sources of information and profit accordingly, but nevertheless it is the general opinion of the various concerns responsible for these departments that much more use could be made of them in the extensive development of Canadian industries. Mistakes have been made in the investment of capital in Canada which they think could have been avoided by inquiry."

These agencies are all anxious to render service and should be given every opportunity to do so.

Investigation Before Investment

Scientific investigation from every angle before any industry is induced to locate in Canada should be the rule from now on, and this applies to Canadian branches of successful American manufacturers as well as to what might be termed entirely new Canadian industries; otherwise, the number of failures will be abnormally high. This places a heavy responsibility on public utility corporations anxious to secure new power customers, as without thorough investigation it is conceivable that some manufacturers might be induced to build plants in this country that would be doomed to failure from the start.

A scientific survey of the markets should be first undertaken and, when the market is assured, locate the industry where it can be operated at a profit regardless of " home town " pride or the wrath of the local board of trade. It is stated on good authority that " home town " pride is more responsible for failures and bankruptcy than any other single cause, so that industries should be located where they at least have a fighting chance. Interest and enthusiasm are all right in their place, but they cannot in every case overcome barriers imposed by nature.

International Aspect

That this subject is creating widespread interest is shown in the press reports last fall of the first meeting of the Council of the International Association for the Study and Improvement of Human Relations and Conditions in Industry. The meeting was held in Switzerland, and the discussion was carried on by representatives of eleven nations. It was reported a general discussion took place on the subject of the development of scientific methods in industry. The subject was introduced by Lillian M. Gilbreth, consulting engineer of New Jersey, U.S.A.

It was pointed out that there is room in industry for engineers, economists, physiologists, psychologists, psychiatrists, biologists and other specialists in human sciences. All are engaged in dealing with various aspects of the same problem, and their co-ordination is a vital necessity in the application of scientific methods to industry.

Attention was called to the fact that scientific methods were being extended to new fields. In addition to their application to methods of production, sales, office work and all other branches of industry, scientific methods were being introduced into hospitals, schools, prisons and even the home.

Special emphasis was laid on the need for co-operation on the part of the worker, whatever the task might be. Where this happened there need be no fear as to results. It was argued that the main task of the association might well be to investigate at first hand and report on existing conditions in industry so far as the human element is concerned, and to explain the changes that are taking place, their advantages and their disadvantages. It was further pointed out that *Scientific Management* is only really *scientific* insofar as it takes every industrial factor into consideration, emphasis being placed on the human factor.

In this paper the human factor has not been dealt with, but there are all kinds of problems connected with this phase of the subject where scientific methods of analysis can be and are brought into play; such, for example, in the Sperry gyroscope factory, where the men employed to tool parts beyond an accuracy of one ten-thousandth of an inch feel the triumph of their technical arts in the service of scientific exploration.

Who will say there are not any scientific problems cropping up in the question of the five-day week, which the head of the American Federation of Labour claims is inevitable? Is there also not an opportunity for scientific method where the policy is to operate some businesses on the so-called "Golden Rule" basis, where everything of common concern,—wages, hours, prices, economies, efficiencies, is talked over between employees and their employers? The writer actually knows of a company that recently installed a pension system where, before its final adoption, a most painstaking and scientific analysis of existing pension systems was made. At least careful thought, if not scientific method, is required in cultivating that happiest of graces, the ability to criticize without wounding the self-respect of the other person. Some can do this beautifully, like the boss of whom a loyal employee said, "He bawled me out yesterday, but I didn't know it until three hours later."

Conclusions

Undoubtedly there is strenuous competition ahead for every Canadian industry. It will be necessary, during the next few years, to employ to the limit all our inventive ingenuity, all our engineering skill, every possible aid to increased production, and all our ability to achieve close co-operation between men and management, if we are to succeed in holding our own in the manufacturing world. There are those who wonder how we are able to compete at all against the enormous mass production of similar industries in the United States. As it is, there are several industries in Canada where the output per machine is already higher than similar machines in the United States, and the tendency is for still higher outputs. There can be no standing still, and we should therefore tackle every problem, no matter how insignificant, in as scientific a manner as possible and plan ahead to meet competition from whatever source it may come. Among other things this means that there must not be any waiting for the forecaster or statistical agency to tell us how business is, but that we must go out after it and find it. In other words, export trade as well as the home market must be cultivated.

As someone has said, there has been altogether too much piffle written and printed about business cycles and other mysterious laws that will enable one to know in advance whether business is going to be good or bad. The idea of quitting because some mathematicians figure out by algebraic formulæ that it is time to stage a panic is not in keeping with the enterprising spirit that has sustained this country in the past.

From what has been discussed in this paper it will be seen that there is nothing new in the scientific method, but that it is simply a case of planning ahead, devoting sufficient thought to the problem at hand and utilizing every possible source of information that will place the facts at your disposal.

The following words of Napoleon are as true to-day as when they were uttered:—

> "For everything you must have a plan. Whatever is not profoundly considered in its detail, produces no good results. I trust nothing to chance."

Rainfall and Run-off

A Consideration of Their Relation with a View to Estimating the Discharge of Streams from Records of Precipitation

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Intensity of rainfall and the resultant flood discharge, or total annual rainfall and the resultant run-off, are perhaps the two main problems that arise in a study of this subject, and it is proposed to deal briefly with the former and rather more in detail with the latter.

Flood Discharge

Rainfall differs to an extraordinary extent between various places, from almost nothing to 500 inches or more in a year. The intensity of rainfall cannot be gauged by the average annual rainfall where this is small; for instance, in Cairo, Egypt, the mean annual rainfall is about one inch, while one inch has been recorded on a single day.

It is stated that at the Sweetwater dam in California on January 27th, 1916, the 24-hour rainfall was equal to the mean annual rainfall, (21 inches), as established by 66 years' records. The annual rainfall at Victoria is 27.65 inches; one wonders what Victorians would think if 40 inches fell in 24 hours, as has been recorded at Cherra Punji.

The intensity of the rainfall varies with the area considered, that is, a small area is liable to have a higher rainfall in a given time than a larger area; consequently, the discharge from a small drainage basin may be greater per square mile than that from a larger area.

Many attempts have been made by engineers to establish some definite relationship between drainage area, rainfall and flood discharge. An interesting example of such a formula was that worked out by Colonel Dickens in India in 1865. He assumed for a small area a rainfall of 4 inches in one hour; then he borrowed Sir P. Cautley's figure of ½ inch per hour for small rivers and applied it to an area of 50 square miles, (it will be noted that these two are rather arbitrary); to these he added known flood discharges of ⅛ inch per hour over a drainage area of 7,000 square miles and of 1/10 inch per hour over 27,000 square miles.

Table No. 1—Application of Formula Establishing Relation between Drainage Area, Rainfall and Flood Discharge.

Area Sq. Miles	Max. Run-off	4th Root Area	Product 2 and 3
1/80	4″	⅓	1.33
50	½″	2.5	1.25
7000	⅛″	9.0	1.13
27000	1/10″	13.0	1.30

Capilano River, 64 sq. miles
Oct, 24, 1921 .... 460 c.f.s.
Oct. 28, 1921 .... 16,900 c.f.s.
By formula:—18, 240 c.f.s.

Run-off in rainfall inches per hour $=1.25 \div A^{0.25}$ or flood discharge in cubic feet per second $=806\ A^{0.75}$.

Setting these out as shown in columns 1 and 2 of table No. 1, he found that the fourth root of the area, (column 3), multiplied by the run-off in rainfall inches per hour, (column 2), gave the figures in column 4; averaging these last as 1.25, it gave the formula:—

$$R \times \sqrt[4]{A} = 1.25 \text{ or } R = \frac{1.25}{A^{0.25}}$$

Where R = run-off in rainfall inches per hour,
A = drainage area in square miles.

Changing this into cubic feet per second units, we get:—
Flood discharge in c.f.s. = $806\ A^{0.75}$
or, as it was usually taken, $825\ A^{0.75}$

This gives, of course, an approximation: for instance, in certain mountainous areas with heavy rainfall intensity a figure of $1{,}600\ A^{0.75}$ was adopted by the designer of bridge openings, etc.

Desiring to check this formula against some British Columbia stream, the heavy precipitation at the coast in October 1921 came to mind, and Capilano river was referred to. It was found that on October 24th the discharge was 460 c.f.s. and on the 28th, 16,900 c.f.s. With a drainage area of 64 square miles, Dickens' formula would give 18,670 c.f.s. as the maximum flood discharge.

The objection to Colonel Dickens' formula lies in the fact that the shape of the drainage basin is not considered. This question of the configuration of the land has been investigated by many in its relationship to flood discharge, an interesting study of this kind being that by Mr. G. E. Lillie*, in connection with the design of waterways of bridges. In a particular instance, an area of 3,000 square feet had been provided as a passage for floods, which, it was estimated, might reach a maximum rate of 26,000 c.f.s.; however, a flood of 44,000 c.f.s. occurred and some damage was done. The following year a phenomenal flood occurred

* Proc., Inst. C.E., vol. 217, 1924.

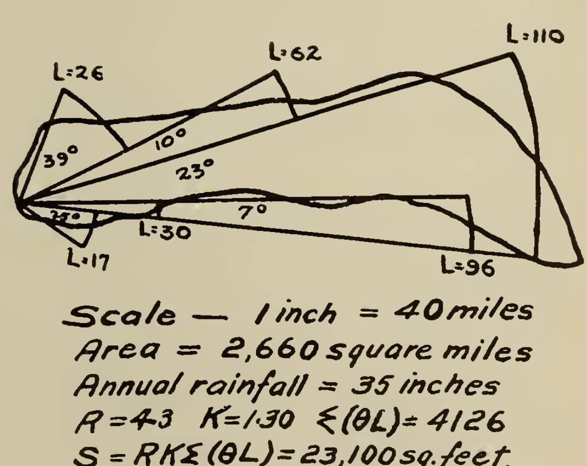


Figure No. 1.—Application of Lillie's Method of Determining Flood Discharge and Area of Necessary Waterway.

Figure No. 2.—Contiguous Watersheds Used in Experiment to Determine Relation of Forest Cover to Run-off.

and the whole structure was carried away, the superintending engineer calculating the discharge as 132,475 c.f.s. The waterway provided on rebuilding was 23,325 square feet.

Mr. Lillie's method is to divide the drainage area into sectors of circles of different radii, but all concentric with the point of discharge. The sum of the values obtained by multiplying the angles by the radii lengths in miles is further multiplied by two variants, values of which are obtained from curves based on the annual rainfall and the greatest length of the drainage area.

The illustration, figure No. 1, covers the particular case already referred to, this formula giving 23,100 square feet as the necessary waterway.

One of the many debatable points in this problem is the relation of forest cover to run-off. A practical experiment in this regard has been carried out at Wagon Wheel Gap, Colorado,* but the final report has not been issued yet. Two contiguous watersheds of about 200 acres were selected, the relative shape being as shown in figure No. 2.

Rain gauges, recording thermographs, snowfall depth and density stations were established and soil temperatures and soil moisture percentages recorded, while the geology, forest cover, relation of slope to sunshine, etc., were all covered in the most thorough manner.

From 1911 to 1919 data was obtained from both watersheds, and these are incorporated in a report issued in 1922. By the autumn of 1920, watershed *B* had been denuded of its forest cover, and the report on these further years will be issued shortly and should be of great value as it will reveal not only whether there is greater rapidity in the run-off but also whether there is greater total run-off. Among the points of interest is a graph showing the relative run-off of the two areas following a rainfall of 2.6 inches in 24 hours. (See figure No. 3.)

* Monthly Weather Review. Supplement No. 17, 1922. United States Dept. of Agriculture.

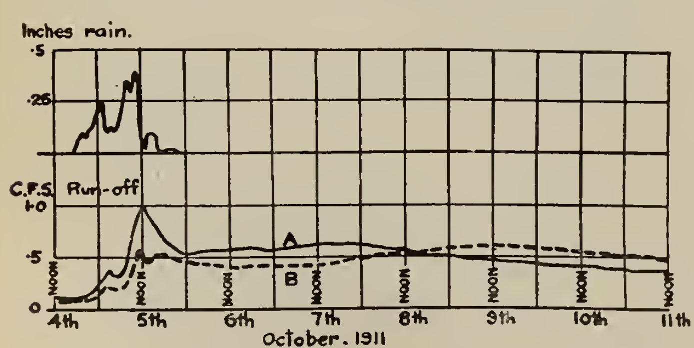


Figure No. 3.—Relative Run-off of Two Contiguous Watersheds Used in Determining Relation of Forest Cover to Run-off.

It will be noticed that *A* rises more rapidly than *B*, although *B* later has a greater flow than its own first crest. It should be noted that *B* has 200 acres within 950 feet of the stream, *A* has 200 acres within 670 feet of the stream.

Total Annual Run-Off

Leaving the question of flood discharge, let us turn to that of total run-off, the use of which perhaps is desired for power or irrigation.

A number of formulæ have been proposed by which the run-off is calculated as a percentage of the rainfall with other features such as slope or temperature sometimes included. One or two might be mentioned for the sake of interest, and to emphasize the fact that before adopting any one formula it is essential to know the data on which it was based and whether it is applicable to other places or conditions.

The following ratio is often used in the United States:—The run-off is taken as a percentage of the annual rainfall, numerically equal to the inches of rainfall up to 50 inches; and for rainfall of over 50 inches a reduction of 25 inches is made for losses, the balance being taken as the run-off.

Figure No. 4.—General Plan showing Location of Guichon Creek.

For example:—

With 10 ins. rainfall, run-off is 10% of 10 = 1 in.
" 20 " " " " 20% of 20 = 4 ins.
" 75 " " " " 75 − 25 = 50 ins.

Applying this to certain British Columbia streams that have been investigated, the results shown in table No. 1a give a comparison of the actual run-off with the figures obtained by the above method of calculation based on the rainfall.

Table No. 1a—Comparison of Actual Run-off with Results of Calculated Run-off Based on Rainfall.

Stream	Average Rainfall		Run-off in Inches	
	Period	Inches	Calculated	Actual
Guichon Creek..........	10 years	10.89	1.18	0.69
West Kettle River.......	4 "	15.52	2.41	6.91
Alouette River..........	13 "	102.81	77.81	77.8

It should be noted that often the location of the rainfall stations does not give a good average for the area considered.

Another formula of considerable interest was evolved from a consideration of certain streams in the north-eastern states. It was found that the run-off varied as the square

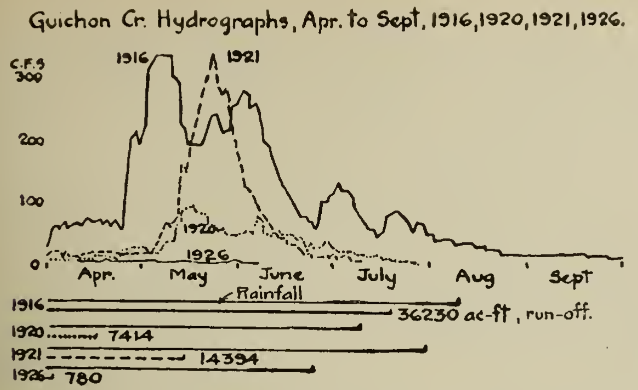


Figure No. 5.—Comparative Hydrographs of Guichon Creek.

of the rainfall multiplied by a variant, so that the primary equation was:—

$$C \text{ (run-off)} = K \times R^2 \text{ (rainfall)}$$

The elucidation of K is the interesting feature; temperature and slope were reckoned to be the chief considerations, and slope was allowed for in this fashion, *i.e.*, the elevation of the lowest point in the watershed was deducted from the elevation of the highest point and the result divided by the square root of the area; the value obtained being then raised to the 0.155 power. A constant 0.934 was introduced as a multiplier, and the result divided by the temperature.

The final equation became:—

$$C = 0.934 \times S^{0.155} \times \frac{R^2}{T}$$

Applying this to Guichon creek, it gives a ten-year mean run-off of 5.48 inches against an actual 0.69 inch. The reason for this can be gathered from the fact that while the table given by the author of values for S ranges

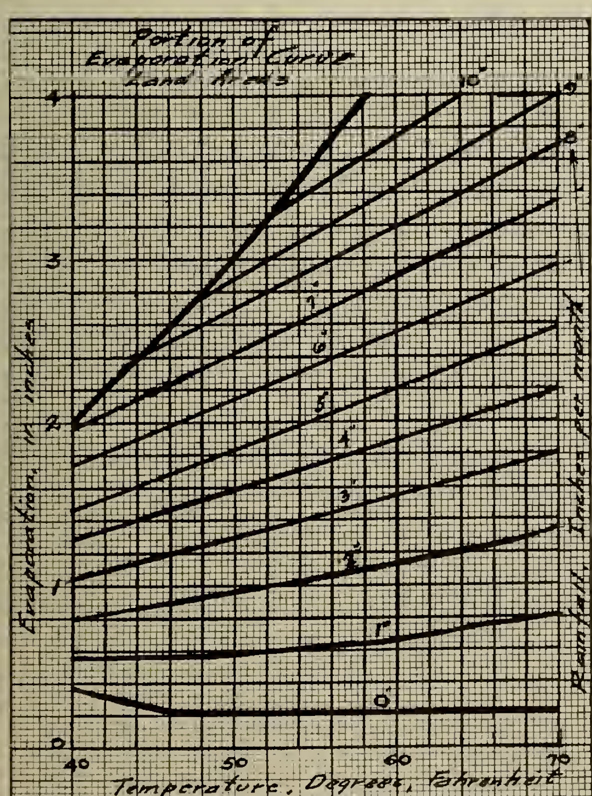


Figure No. 6.—Evaporation Curve Reproduced in Part from Paper by Mr. Adolph Meyer.

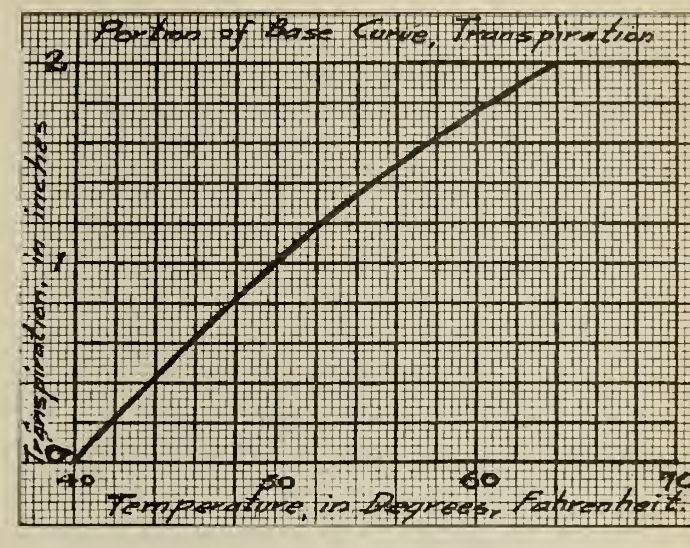


Figure No. 7.—Transpiration Curve Reproduced in Part from Paper by Mr. Adolph Meyer.

from 0.002 to 0.07, S for Guichon creek = 163.4. It is evident that this formula is not suited to British Columbia conditions.

It might be stated at this point that the reason for a study of this problem arose from the extraordinary change in the amount of water available for irrigation from Guichon creek, a tributary of the Nicola river.

Figure No. 4 shows the location of this creek, its position relative to the Coldwater and Nicola rivers and to the cities of Kamloops and Merritt. The gauging station is just above Mamette lake, and, fortunately, there is also a precipitation station at this point.

Table No. 2—Discharge of Guichon Creek, April to September of Each Year.

Year	Run-off ac.-ft.	Inches Rain	Year	Run-off ac-ft.	Inches Rain
1914	39,561	2.357	1921	14,394	.857
1915	23,630	1.407	1922	10,616	.632
1916	36,230	2.156	1923	6,582	.391
1917	......	....	1924	7,430	.442
1918	6,830	.407	1925	12,571	.744
1919	12,665	.754	1926	780	.046
1920	7,414	.442			

Table No. 2 shows a tabulation of the discharge of Guichon creek for the six irrigation months, April to September, of each year. The sudden change after 1916 is noticeable, while the figure for 1926 is almost unbelievable.

The first thought was, did the Nicola river, or the Coldwater, vary in the same proportion as Guichon creek, and, taking 1920 as the basis of comparison, at 100 per cent, table No. 3 shows the facts:—

Table No. 3—Comparison of the Discharge of Guichon Creek and Coldwater and Nicola Rivers.

Year	315 sq. mi. Guichon Cr.		360 sq. mi. Coldwater R.		2,600 sq. mi. Nicola River, at mouth		1,300 sq. mi. Nicola River, at Nicola	
	ac.-ft.	%	ac.-ft.	%	ac.-ft.	%	ac.-ft.	%
1914	39,561	534	212,058	170	785,515	204	....	..
1915	23,630	319	85,310	69	429,900	112	81,000	95
1916	36,230	489	....	..	944,600	246	145,200	171
1917	(39,000)	(529)	186,200	150	573,600	150	115,190	135
1918	6,832	92	....	..	536,600	140	....	..
1919	12,665	171	247,420	199	714,400	186	....	..
1920	7,414	100	124,320	100	383,500	100	85,022	100
1921	14,394	194	262,537	205	....	..	....	..

Figure No. 8.—Average Rainfall of Four Typical Stations in British Columbia.

Unfortunately, as so frequently occurs, records are disjointed and prevent a complete comparison, but it is at once patent that in the earlier years Guichon creek had a discharge much more than proportionately large. It was curious that there was some trouble over the gauge and measuring section on Guichon creek in the earlier years, which suggested a possible error in the peak discharge figures, but a plotting of the hydrographs for four comparative years showed this could not be so, as the peak discharge was about 335 c.f.s. in two years of very different total run-off. These comparative hydrographs are shown in figure No. 5.

Table No. 4 shows the precipitation at Mamette lake and run-off of Guichon creek for those years in which the rainfall was measured at Mamette lake, snow being included in the rainfall on the ratio of ten inches of snow being equal to one inch of rain.

Table No. 4—Discharge of Guichon Creek and Precipitation at Mamette Lake.

Year	Run-off ac.-ft.	Mamette L. Rainfall	Run-off inches	Per cent. Rainfall
1915–16	36,230	12.56 (A)	2.156	17.17
1916–17	.....	10.70	.....	.....
1917–18	6,830	11.45	.407	3.55
1918–19	12,665	8.33 (B)	.754	9.05
1919–20	7,414	9.58	.442	4.61
1920–21	14,394	11.60	.857	7.39
1921–22	10,616	12.10	.632	5.22
1922–23	6,582	12.62 (A)	.391	3.09
1923–24	7,430	12.12	.442	3.65
1924–25	12,571	10.45	.744	7.12
1925–26	780	8.11 (B)	.046	.57

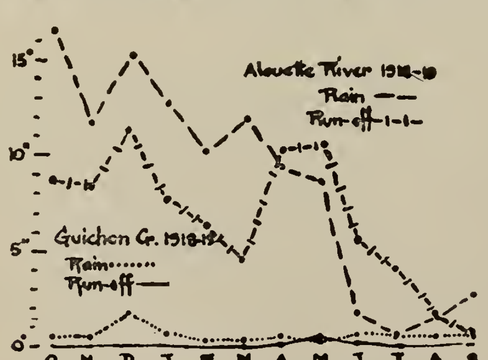


Figure No. 9.—Comparative Curves showing Relation of Rainfall and Run-off of Alouette River and Guichon Creek.

It will be noted that the years 1915-1916 and 1922-1923 are marked with the letter (*A*) and the years 1918-1919 and 1925-1926 with the letter (*B*). These two pairs of years give a definite point in the general problem; pair *A*, (maximum precipitation), with a rainfall of about 12.60 inches, had run-offs of 36,230 and 6,582 acre-feet respectively, pair *B*, (minimum precipitation), with a rainfall of about 8.25 inches, had run-offs of 12,665 and 780 acre-feet respectively.

It is unnecessary to follow here the various lines of approach that were tried in an effort to explain this, but eventually certain references led to a paper in the Transactions of the American Society of Civil Engineers, vol. 79, 1915, by Adolph Meyer, in which the results of a very thorough investigation into the conditions affecting run-off are set forth.

For the benefit of those to whom the paper is not available, the following brief outline is given:—The method is based on the equation that *run-off* equals *precipitation* minus *total loss; total loss* covering, as a general rule, losses by evaporation from land area, by evaporation from water areas and transpiration by vegetation.

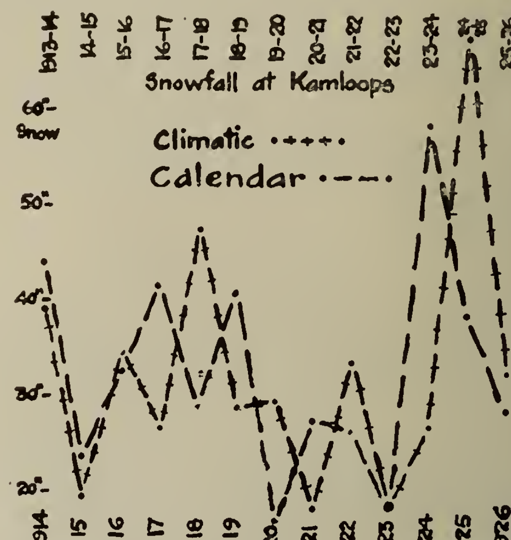


Figure No. 10.—Graph showing Effect of Allocation of Snowfall when Climatic and Calendar Years Are Considered.

The three main factors affecting evaporation from land areas are temperature, humidity and wind; the first being of outstanding importance.

The maximum vapour pressure of the atmosphere doubles for every increase of approximately 18° F., so that if the humidity is constant the rate of evaporation is approximately doubled for every 18° rise in temperature. The relative humidity varies considerably in months of high or low precipitation, with the result that the higher the rainfall the less in proportion the rate of evaporation. The variation is less in early spring than in the fall, since the moisture available for evaporation in spring is less dependent on rainfall than in the fall.

Another point worthy of notice is that the relative humidity varies only slightly with changes in altitude of two or three thousand feet.

During the winter months there is considerable evaporation from snow and ice. It is stated that for a monthly mean temperature of 23° F. the mean of the daily maximum temperatures is 32° F., and for a monthly mean temperature of 41° F. the mean of the daily minimum temperatures is about 32° F. A certain amount of thawing will take place when the monthly mean temperature reaches 18° to 20° F.

The questions of soil temperatures, soil moisture available, the relation between irrigation and evaporation, vegetation, percolation, capillary action, etc., are thoroughly discussed in the paper mentioned above, and many graphs are given.

Finally, an *evaporation curve*, which is reproduced in part in figure No. 6, is evolved, by the use of which it is possible to arrive at the evaporation loss with any monthly precipitation and any mean monthly temperature.

The paper also contains a graph showing the loss by evaporation from water, snow and ice. Relatively large bodies of water remain frozen in spring until the mean monthly temperature reaches about 38° F. Until the break-up, the evaporation is from snow and ice surfaces, and is greater at the same temperature than from the relatively cold water immediately after the break-up.

Estimates of annual transpiration vary a great deal, but most of the values for forest trees and small grains are from 4 to 9 inches per year, with occasionally up to 14 and 15 inches for oats and some grasses. The basic law is that chemical reactions and physiological processes double in activity with every rise in temperature of 10°.

The relation of transpiration to available moisture and precipitation to the growth of vegetable substance, (*i.e.*, weight produced, in which there is almost a direct relationship); the percentage of moisture content of the soil that causes wilting, the variations of vegetation in watersheds, etc., are discussed, and finally a *transpiration curve*, which is reproduced in part in figure No. 7, is given, from which the transpiration loss per month corresponding to the mean monthly temperature is taken.

It should be noted that since the total evaporation and transpiration possible depend largely on the total moisture available through the precipitation, and also on the locality of the watershed, the total losses under each head are subject to corrections related to the local conditions.

The *precipitation* minus *total loss* method is then applied by the author to fifteen watersheds having mean annual precipitations varying from 14.8 to 61.9 inches and run-offs varying from 0.74 to 54 inches. Altogether, data covering some one hundred and forty-four run-off years are worked out, and many examples given, the results being exceedingly good.

In this connection, one or two points of interest deserve attention. The first is the difference in the monthly distribution of rainfall in different localities. The average rainfall at four typical stations in British Columbia, namely, Glacier, Barkerville, one near Victoria and one near Kamloops, are given in figure No. 8.

The similarity between the Sooke lake, (near Victoria), and Glacier distribution is noticeable, with high precipitation in the winter and low in summer, while Knouff lake, (near Kamloops), is representative of the southern central area, with January and June having slightly the highest average rainfall. Barkerville is representative of another section with a very evenly distributed precipitation.

A further point worthy of notice is the relative occurrence of run-off to rainfall. Under certain conditions, the amount of precipitation finds an immediate corresponding effect in the stream discharge, but in others the run-off occurs without any such immediate relationship. This is well illustrated by the graphs shown in figure No. 9; on the Alouette river the relationship is evident, while on Guichon creek precipitation rarely shows any immediate effect.

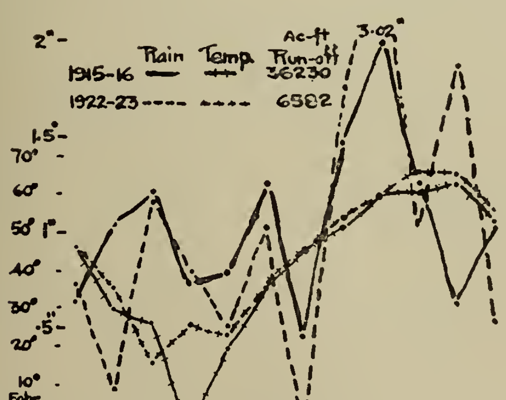
A third point of importance is the selection of the starting point for the twelve months to be used for comparison. That the use of the calendar year is often undesirable is evident from a consideration, for instance, of the snowfall at Kamloops. The winter snowfall evidently affects the following spring run-off, and it cannot have any bearing on the previous season. The starting point should be that month when ground-water and run-off conditions are as far as possible the same in each year. In British Columbia, the stream discharge measurements are compiled for a climatic year commencing the first of October, and this appears to be a very suitable division to be used in a study of the relation of run-off to precipitation in this province. The difference this makes in regard to the allocation of snowfall at Kamloops emphasizes this point, as will be seen from table No. 5, from which the accompanying graph in figure No. 10 has been prepared:—

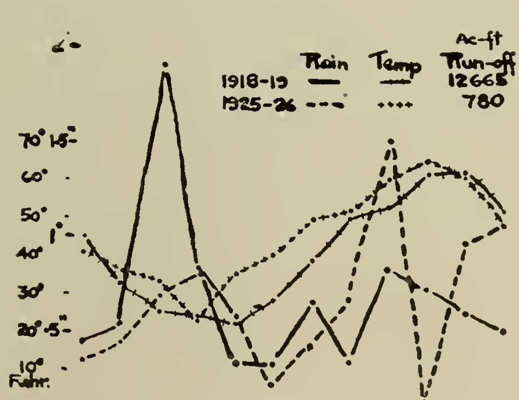
Table No. 5—Snowfall at Kamloops.

Calendar Year	Climatic Year	Calendar Year	Climatic Year
Inches	Inches	Inches	Inches
1916......32.62	1915–16..34.85	1922.....26.35	1921–22..33.80
1917......41.50	1916–17..26.62	1923.....18.25	1922–23..18.25
1918......29.00	1917–18..47.50	1924.....58.20	1923–24..26.95
1919......40.75	1918–19..28.75	1925.....38.35	1924–25..67.45
1920......17.00	1919–20..29.75	1926.....28.20	1925–26..32.10
1921......27.45	1920–21..18.25		

All available data on temperature, humidity and precipitation for the period required was obtained for Kamloops, Nicola lake, Merritt and Mamette lake, and run-off measurements on Guichon creek above Mamette lake and at the mouth, Nicola river at the lake and at the mouth and Coldwater river for comparison.

The method outlined above was applied to those years for which the Guichon creek run-off measurements, Mamette lake precipitation and Merritt temperatures were





Figures Nos. 11 and 12.—Graphs of Pairs of Years Affording Comparison of Conditions that Affect the Run-off.

available, except that for the years 1915 to 1918 the Kamloops temperatures were reduced to approximate Merritt temperatures by means of a graph based on average differences.

It should be remembered that total precipitation and losses cover twelve months and measured run-off only the six irrigation months.

The results in regard to the pairs of years previously mentioned and also for the average over ten years are given in table No. 6.

Table No. 6.

Year	Total Rainfall	Trans. Loss	Evap. Loss	Total Loss	Calc'td Run-off	Meas'd Run-off
	Inches	Inches	Inches	Inches	Inches	Inches
1915–16........	12.56	4.86	5.58	10.44	2.12	2.156
1922–23........	12.62	5.35	6.88	12.23	0.39	0.391
1918–19........	8.33	3.22	4.22	7.44	0.89	0.754
1925–26........	8.11	3.90	4.18	8.08	0.03	0.046
10 Yr. Mean....	10.89	4.64	5.36	10.00	0.89	0.69

That Adolph Meyer's method was based on a very thorough study of available data, and of the many conditions affecting the distribution of the annual precipitation into seepage, run-off, evaporation, transpiration, etc., and that his three main curves of evaporation from land areas, evaporation from water areas and transpiration are of undoubted utility and average value, is shown not only by his own application of them but by the explanation that they give of the problem on Guichon creek.

It undoubtedly surprises the uninitiated to find that a combination of the monthly precipitation and the mean monthly temperature is sufficient to account for the wide differences of stream flow. Attention might also be drawn to the fact, as a matter of interest, that with a ten-year total precipitation of 108.92 inches the total run-off on Guichon creek was 6.87 inches, or a relative loss of 102 inches out of 109 inches of rain.

Figures Nos. 11 and 12 show graphs of the pairs of years dealt with, which may give a more easily grasped comparison of the conditions that affected the flow.

There are many details of interest that have been passed over and points of difficulty met with in the application of Meyer's method on which much could be said, but it is particularly desired that there should be opportunity for discussion and for gaining the added knowledge that others can contribute from their own experiences. It might be mentioned that in the province of British Columbia there are about 200 rainfall stations, 110 temperature stations and about 250 measurement stations on rivers and streams.

This closing remark, however, is necessary; that the value of this method in the consideration of any particular drainage area depends largely upon the value of the available rainfall and temperature records relative to that drainage area.

The Vallee Distribution Substation in Montreal

A 60,000-Kilowatt Distribution Substation Recently Built by the Montreal Light, Heat and Power Consolidated in the Business District of the City of Montreal

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Paper read before the Montreal Branch of The Engineering Institute of Canada, April 21st, 1927

The building of the Vallee substation was part of a comprehensive construction programme designed to meet the growth of the city of Montreal. In locating and designing the station, every effort was made to anticipate the conditions to be met for many years in the future.

The location of the substation was not decided upon until a complete survey of the entire city was made with respect to the existing and probable future demands for electrical service. The results of this survey were shown graphically on a map of the city, and on this map each 25 kw. of load was represented by a red dot. The density of these dots therefore showed graphically what sections of the city were most heavily loaded, and gave an indication of where substations should be located. The actual map on which the load was thus plotted cannot be conveniently reproduced here. The map of the city was divided into districts for distribution purposes, and, after deciding the boundaries of these districts, the theoretical centre of gravity of the downtown district was determined. Subsequently, a suitable site was found near enough to the centre of gravity of the load. The lot is about one hundred feet south of St. Catherine street and two blocks east of Bleury street.

The design of the station was not finally adopted until after an inspection had been made by engineers of the company of the most recently constructed substations in twelve of the largest cities on the North American continent. The main result accomplished by this inspection was the assurance that none of the important recent developments had been overlooked.

The capacity of the station was determined after considering the existing load in the district, which is approximately 40,000 kw. This is an old section of the city, and the growth which is taking place is due to the replacement of small buildings by buildings of greater height, devoted principally to light manufacturing and larger retail stores. An increase in load of 50 per cent was considered a reasonable provision, thus bringing the ultimate capacity of the station up to 60,000 kw. All of this power is to be distributed at 4,000 volts, with the exception of the relatively small amount of power to be used for street lighting in this district, viz., about 2,000 kw.

This capacity of 60,000 kw. in one substation is somewhat larger than any substation of this character on record, and it was necessary to justify this capacity by extensive analysis. The result was that the 60,000-kw. design was finally adopted, but in doing so it was necessary to bear in mind that this constituted the " carrying of a large number of eggs in one basket " and that it was essential to adopt every practical precaution to safeguard against the spreading of operating troubles from one part of the station to another. This will explain, in general, the apparent extreme precautions taken in the sectionalizing of the station.

General Design of Station

The following description refers to the complete design of the station for the full capacity of 60,000 kw., it being understood that up to the present time only half of the capacity has been installed, viz., 30,000 kw. The ultimate design divides the station into four sections, each having a nominal capacity of 15,000 kv.a.

This nominal rating is based on a temperature rise of only 35° C., which is a very conservative temperature. The transformers are guaranteed to carry safely a 50 per cent overload for two hours. The station is therefore capable of carrying safely a load of 90,000 kv.a. for two hours, and if one of the four units should be out of service the station would still have a capacity of 67,500 kv.a.

Figure No. 1 is a general view of the building, while figure No. 2 is a cross-section through it.

The station is divided into four sections by fire walls, and if at any time serious trouble should arise in one of these sections, causing it to be shut down, operation can still be maintained in the other three sections. This sectional unit plan of design has another obvious advantage, viz., it is possible to add to the station one section at a time as the growth of the business demands, thus avoiding unnecessary expenditure a number of years in advance of requirements.

The next important step in the design was to decide how many outgoing 4,000-volt feeders would ultimately be required. This depended upon the load which would be put on each feeder, and it was decided to design each feeder to carry a maximum of 1,200 kv.a. All feeders, of course, will not be loaded to full capacity at the same time, there being a certain diversity factor. Taking this into account, it was decided to have a total of seventy outgoing 4,000-volt feeders.

The length of the station was determined by the space required for the main transformers. It was found impossible to locate seventy outgoing feeders within the space required for four banks of transformers unless the feeder equipment was arranged on two floors. This would have led to a complicated arrangement of buses, and it was seen that by adding another floor it was possible to get the required number of feeders in the available space and at the same time simplify the design by the adoption of the isolated phase system, placing one phase on each floor. There was no precedent for the use of a vertical isolated phase arrangement in a substation, but the idea has been fully tried out in generating stations. It was also found that the isolated phase design of substations was under consideration by two of the large companies in the United States.

Another question to be decided was the voltage at which the power was to be brought into the station, whether at 12,000 volts, the same as at existing city substations, or at 60,000 volts, which would mean the use of 60,000-volt underground cable, as this station is in the underground area of the city.

At the time that it was necessary to start the construction of the station, 60,000-volt cable had been in service only two years, (in Cleveland, Ohio), and it was felt that it had not been sufficiently well established to justify the designing of this station to depend entirely on 66,000-volt cables. Accordingly, the station was laid out to take power initially at either voltage, viz., 12,000 or 60,000 volts.

The foregoing will explain the reasons for the rather unusual features which may be noted in the following description.

The course of the power through the station is as follows:—The 12,000-volt cables come from the basement up the wall through oil circuit breakers located on each of the phase floors A, B and C, into the 12,000-volt bus, thence through disconnecting switches to the transformers; thence through 4,000-volt oil circuit breakers located on the A, B and C floors and thence to the 4,000-volt duplicate buses. Each of the outgoing 4-kv. feeders has an oil circuit breaker on each of the phase floors, from which cables extend through conduits down the walls to the basement. One-half of the feeders are located on the east side of the station and the other half on the west side. Each feeder has selector breakers, so that it may be operated from either the east bus or the west bus. The feeders all go out underground.

Figure No. 1.—General View of Vallee Substation.

Induction voltage regulators were installed in the 4-kv. leads of one of the banks of transformers, and provision was made for the installation of regulators on each bank in the future. These bank voltage regulators will naturally permit the raising or lowering of the voltage of the 4-kv. buses. Likewise, provision was made for the installation of an induction voltage regulator on each phase of each outgoing 4-kv. feeder. Regulators have been installed on nine feeders and additional regulators will be added as required. Space is provided also for the installation, in the future, of a current limiting reactor in each phase of each outgoing feeder.

The alternative incoming lines, viz., the 60-kv. cables, enter the station from Benoit street, passing under the station in fibre conduits, thence up the wall to the fifth floor, on which is located all of the 60-kv. switching equipment, buses, etc. There are two incoming 60-kv. feeders, each controlled by an oil circuit breaker connecting the feeder to the bus. Provision is made for one additional 60-kv. feeder in the first half and three in the second half of the station. The power is passed through an oil circuit breaker to each bank of transformers. These transformers have their high tension windings divided into five equal sections, which are operated in multiple for 12,000-volt operation and can be reconnected in series when the time arrives to change over to 60-kv. operation. One bank of transformers may be operated from 60 kv. while the other bank is operating from 12 kv. In this way, the change-over will be made from 12 kv. to 60 kv. operation.

All the equipment of the station is electrically controlled by one operator located on the fifth floor. One of the objections to isolated phase equipment in the past has been the complication of mechanical connections between the three floors. These mechanical connections have been eliminated by providing each breaker on each floor with an independent electric control. The operator closes one control switch on the fifth floor which energizes each of the electric controls on the three phase floors simultaneously. Each of the feeder breakers is automatic, and, in case of an accidental ground occurring on any outgoing feeder on one phase only, the one phase in trouble is cleared by the opening of the breaker on that phase. The breakers on the other two phases of this feeder will remain closed and service on them will continue uninterrupted. This particular feature has been tried out elsewhere and has been found advantageous.

The street lighting equipment is located on the fifth floor, where it is readily accessible for inspection by the operator.

Cooling System for Transformers

The transformers are water cooled, and, to provide an economical supply of water, a well was driven, but after going down 1,000 feet the quantity of water available from the well was still less than the amount required for the transformers, and it was therefore decided to install a spray

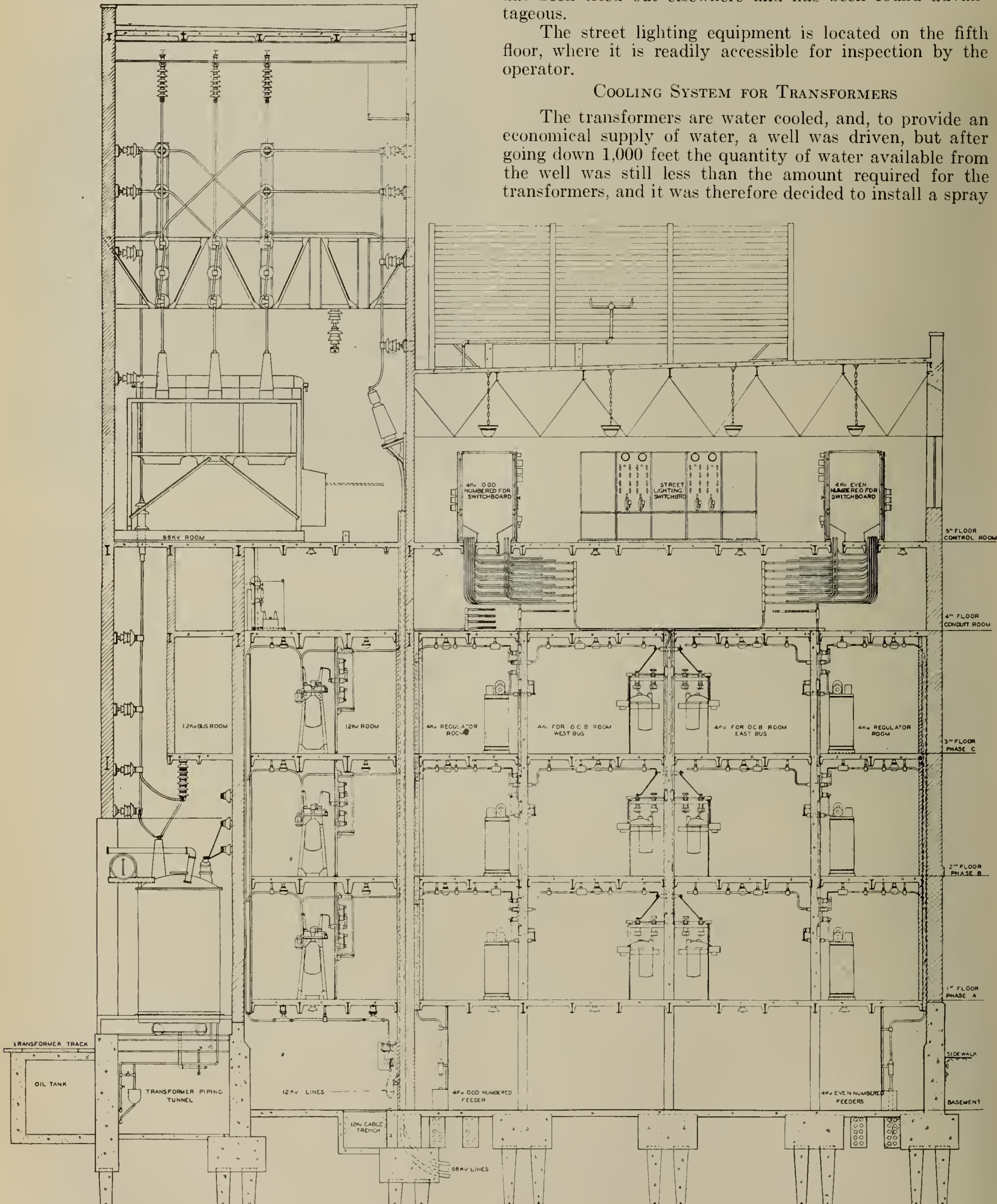

Figure No. 2.—Cross-section of Vallee Station.

Figure No. 3.—Oil Circuit Breaker Cells.

cooling outfit on the roof of the station. In this way, the water will be used over and over again and the well has to supply only the make-up water to replace the quantity lost by evaporation on the roof, which is much less than the capacity of the well.

The transformers are arranged so as to have the advantages of outdoor installation without the disadvantages. The disadvantages of outdoor installation are eliminated by bringing all of the piping from the transformers out through the bottom and enclosing the bottom of the transformer so that all of this piping will be at indoor temperature, this space being a portion of the basement. This arrangement prevents the water piping from freezing and makes it easy for an operator to inspect the water flow and open or close valves when necessary in the coldest weather. In the event of a fire in a transformer, there is the advantage of an outdoor layout, in that the smoke would not interfere with other equipment, as it does in the case of an indoor layout.

The bushings of the transformer are protected from excessive deposits of snow by being set in the recesses of the building, as shown in figure No. 1. In this connection, the designers at first considered the possibility of using outdoor equipment on the roof for controlling the 60-kv. system, but this idea was soon discarded because of the possibility of adjacent buildings being erected higher than the equipment and the danger of having things thrown upon the live parts.

Provision is made for a spare single-phase transformer which will be installed in line with the other transformers. This spare transformer will be permanently connected to a high tension and low tension bus extending the entire length of the station. In case any transformer breaks down, it will be disconnected and in its place the spare transformer will be connected by means of short jumpers attached to the above mentioned bus. In this way, the spare transformer may be put into service without moving it. The damaged transformer will be rolled on its wheels on to a truck which will carry it on a standard gauge track into a repair shop in the front of the building, where a crane is provided with a head room of 36 feet, so that the core and coils may be removed from the transformer.

The 4-kv. oil circuit breakers were built according to the specifications of the company and have certain new features. The design eliminates disconnecting switches, which would otherwise be necessary. Both sides of the circuit breaker are disconnected from the circuit by lowering the breaker in the cell with a hoist truck built for the purpose. After lowering the breaker, an insulating barrier is inserted between the live contacts above and the breaker below, and work on the breaker may be carried on with safety, it being impossible for the worker to come in contact with live parts. If it is necessary to have access to all parts of the breaker for extensive inspection or overhauling, it may be rolled out of the cell to the repair shop.

Control Room

The control boards are arranged on four sides of a rectangle, so that the operator sitting at his desk in the centre of the rectangle may, without leaving his desk, see the condition of every circuit by means of the indicating instruments and signal lights on each control panel. In front of the operator as he faces his desk is the board which controls the incoming lines, both 12-kv. and 60-kv., together with the transformer banks. On his left is a switchboard controlling one-half of the 4-kv. circuits, numbered with even numbers, 2, 4, 6, etc. On his right is an identical

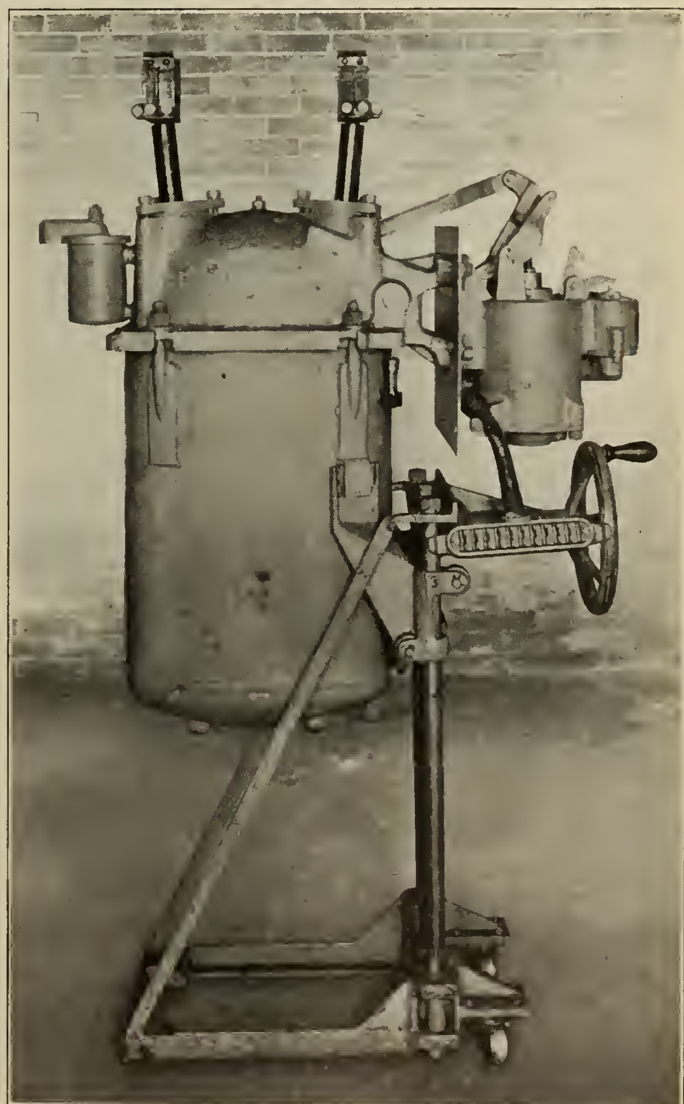

Figure No. 4.—Oil Circuit Breaker on Truck Removed from Cell.

board controlling the other half of the 4-kv. circuits, numbered 1, 3, 5, etc. To the rear of the operator is a switchboard controlling the street lighting system, and to the rear of that board are the street lighting transformers.

On the front of the panel are indicating instruments, signal lamps and control switch handles. At the back of each panel is a corresponding panel carrying automatic relays, contactors, etc. At the top of the panel is a signal lamp carrying the number of the feeder. In case the feeder trips out automatically a bell rings and the number is lighted, so that the operator knows at once which feeder has tripped out. The panel carries an ammeter, a control switch, three green indicating lamps and three red indicating lamps. Normally, the three red lamps are lighted and the three green lamps are dark, that is, when the feeder is in service. In case one phase only of the feeder trips out, one green lamp lights and the corresponding red lamp goes dark, thus telling the operator which phase is in trouble.

Control or Master Switch

The control switch has a somewhat greater number of functions than the control switches heretofore used. Each feeder has two breakers to each phase, one set for connecting the feeder to the east bus and the other set for the west bus. Normally, it is not desired to tie the east and west bus together, and therefore an interlock is provided so that if the feeder is connected to one bus the other breakers on that feeder cannot be closed.

There will be occasions, however, when the two buses will be intentionally tied together and it will be desired to transfer feeders from one bus to the other without interrupting the feeder even momentarily. To do this, the operator will close a push button switch which will remove the interlocking feature and will permit the operator to close the breakers of this feeder on both buses simultaneously. When he removes his finger from the push button a spring opens it and the interlocking function is restored.

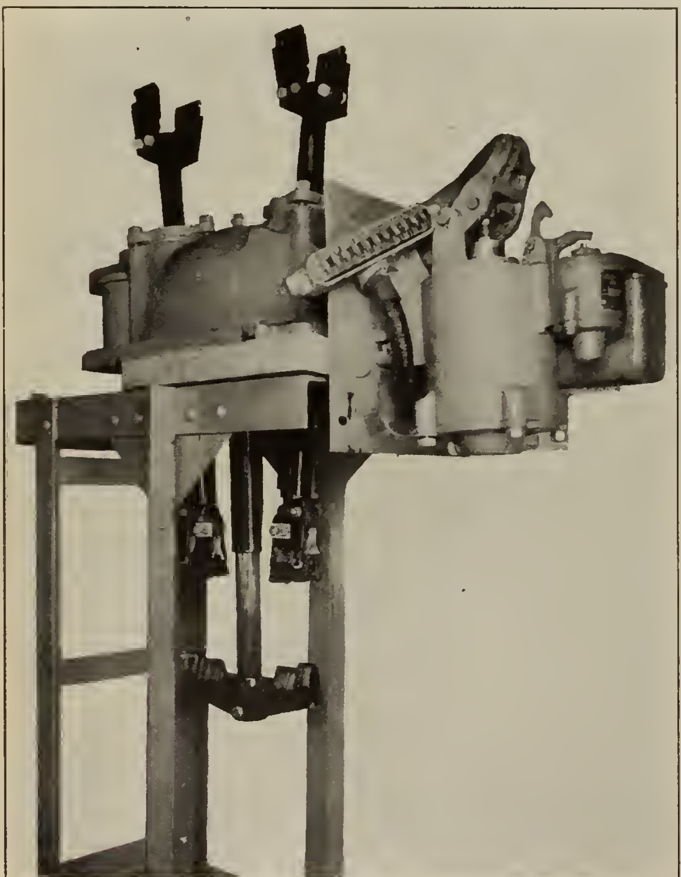

Figure No. 5.—Oil Circuit Breaker with Tank Removed.

Figure No. 6.—View of Operating Room.

At the operator's desk is a telephone connecting to various points in the station so that he can communicate with his assistant while the latter is making his rounds of inspection.

A storage battery is provided for operating all circuit breakers and emergency lights at certain vital points in the station. Normally, the lighting in the station is taken from the alternating current source, but in case this should fail, the emergency lights throughout the station are automatically thrown over from the alternating current to the battery supply, which ensures sufficient light for the work of restoring service. When the alternating current supply is restored, the emergency light switch automatically throws these lights back to the alternating current supply.

The lighting in the control room is totally indirect, the ceiling and roof trusses being painted white and the operator is thus relieved of glare from the lamps.

Fire Extinguishing Equipment

The 4-kv. section of the station is equipped with a carbon dioxide fire extinguishing system. The station is divided into a large number of small fireproof rooms, which is highly desirable for the application of the carbon dioxide system, because it is only necessary to fill a comparatively small volume of space in order to extinguish a fire with a reasonable supply of carbon dioxide.

The carbon dioxide equipment consists of five cylinders located in the basement with permanent piping extending to each of the small rooms, each room having six to eight nozzles. On the outside of the rooms in the stairway space, are located the hand valves for admitting carbon dioxide to any one of the small rooms. As soon as the operator determines in which room the fire is located, he opens the valve to that room and then opens the master valve in the basement by means of an electric push button located on each floor. There has not been, as yet, an accidental fire on which this installation could be tested, but the conditions have been approximated by igniting three pans of alcohol in one of the small rooms, and this fire was extinguished within two or three seconds after the valve was opened. There was an abundance of spare capacity of carbon dioxide as the discharge continued to pour into the room about one and one-half minutes after the fire was extinguished, and within a few seconds of that time men entered the room without any serious discomfort in the matter of breathing.

In order to remove such smoke as may occur by fire there is provided in the basement a forced ventilation system, including a motor-driven exhauster with flues leading to each of the small rooms. This same fan and flue system is normally used for heating the building by means of an electric heater installed in the fresh air intake flue,

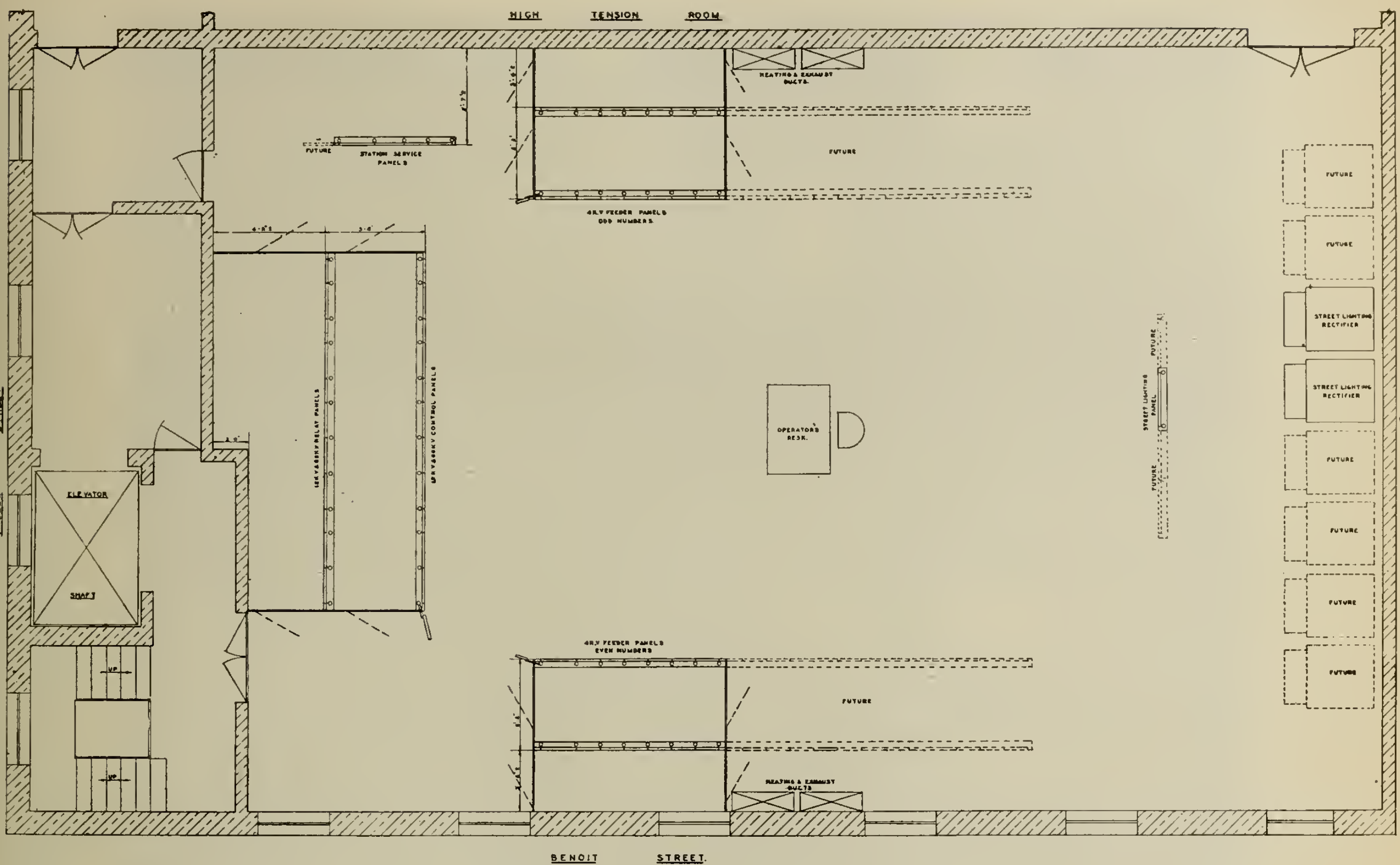

Figure No. 7.—Plan of Operating Room.

which draws fresh air from outside at a point about 30 feet above the street so as to provide clean air. In order to change the system over from a heating system to a smoke exhaust system, it is only necessary to operate a damper in the basement which reverses the direction of the flow of air throughout the building.

66,000-Volt Section of the Station

The station as described in the foregoing was completed during the latter part of 1926 and put into operation on January 15th, 1927, taking power from the 12,000-volt cables and distributing at 4,000 volts. Meanwhile the 66,000-volt cable manufacture and operation having become thoroughly established in Cleveland and Philadelphia, construction of a 66,000-volt cable system to feed this station and the 66,000-volt portion of the station was commenced.

Each of the 66-kv. cables is single conductor 750,000 c.m., carried in a 4½-inch fibre conduit which is built into the masonry wall. There are six of these cables, constituting two 3-phase circuits. Each circuit passes through an oil circuit breaker to the bus. Each bank of transformers is connected to this same bus through an oil circuit breaker. Each of these oil circuit breakers has an interrupting capacity of 1,000,000 kv.a. at 66,000 volts, and each is protected by disconnecting switches on each side. These switches are gang operated by manual mechanism from the main floor. They are of the swivel type adopted because they require a minimum of space.

In order to make it safe for a man to reach the main bus supports for cleaning or replacing, a ladder is provided leading from the main floor to the walkway just under the roof, which extends the full length of the station. A trolley carriage is provided, suspended from the roof beams, which travels across the station in order that each of the insulators may be reached. This trolley can be moved lengthwise of the station along the walkway.

The fire protection of the 66-kv. portion of this station is different from that used in the 4-kv. section. The carbon dioxide system would be too expensive for such a large space as the 66-kv. room, as the number of cylinders of supply would be excessive. The system which is used here is the "Foamite" and consists of a Foamite generator located in a small room adjoining, to which is connected 150 feet of 1½-inch hose which will reach all parts of this floor of the station. Practically the only inflammable thing in this portion of the station is oil. In the unlikely event of an explosion in a circuit breaker which might cause oil to be spilled on the floor, the spread of this oil is prevented by providing a curb 6 inches high, around each breaker. The stream of Foamite can be readily directed over the surface of such a pool of oil, covering the surface of the oil and extinguishing the flame.

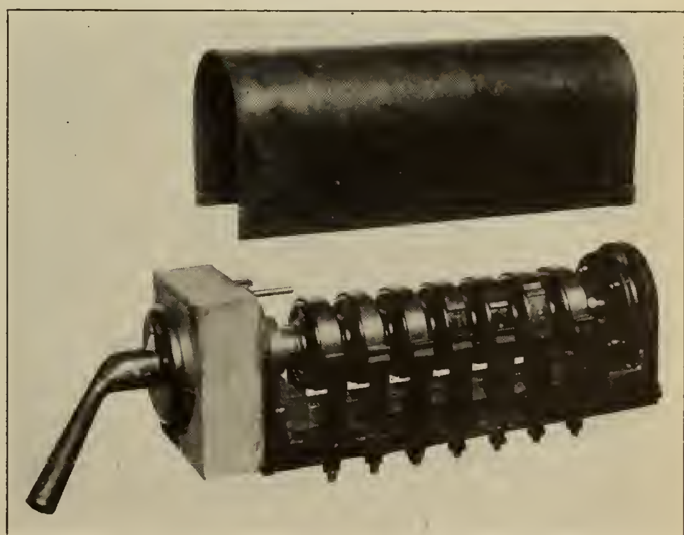

Figure No. 8.—Control or Master Switch.

Figure No. 9.—View of 66-Kv. Section of Station.

Two port holes are provided in the brick wall between the operating room and the 66-kv. room. An operator may look through these port holes and see where the fire is located and direct the stream through one of these port holes.

It is unusual to build a 66-kv. substation in the midst of a downtown section of a large city where space is very limited. This accounts for the fact that there is an unusual amount of high tension apparatus housed in such a relatively small space in this station. However, every live part has at least the standard clearance from all other parts. Furthermore, extra precaution has been taken by covering all 66-kv. buses and connections with a flame-proof insulation. Therefore an arc which might start from any cause cannot form a short circuit between phases or extend beyond the point of failure.

When the second half of the station is built, probably within the next two years, the brick wall at the end of the present half will be left in place, thus forming a fire wall between the two halves of the station.

Kenotron Equipment

There is one more item of equipment to be mentioned, viz., the testing equipment which was used for testing the 66-kv. cables. Each of these cables is only about 4,000 feet long, and one might expect, at first thought, that this short length of cable could be tested with alternate current, in the same manner as in factory tests. However, the charging current, even in this relatively short length cable would be about 10 amperes, which, at the high test voltage, would require quite a large transformer and the first cost of apparatus would be much more than the cost of rectifying equipment. There is also certain objection to the use of alternating current for testing cables after installation, so it was necessary to use rectified potential for testing these cables. The cable specifications called for a direct current test of 218,000 volts for 15 minutes. The equipment used is designed for 225,000 volts direct current, and it has delivered as high as 250,000 volts.

The transformer and low tension equipment is located on the main floor. The testing tubes and high tension connections are located on a floor above, where they are completely separated from all other equipment. From the tubes the connection is made through a large opening in the wall to the main test bus, extending the entire length of the station, which is conveniently located so as to facilitate making a short connection to any one cable, thereby permitting the testing of one cable without interrupting service on other cables.

An automatic arrangement is provided as a safety measure so that no one can enter the high tension tube room while the tubes are alive. The opening of a trap door entering the tube room automatically cuts off power from the testing transformer. There is a similar safety device in the form of an automatic grounding switch which grounds and discharges the test bus and connected cable as soon as power is cut off from the testing transformer. Without such a device the cable would remain charged to a high potential as a condenser for a considerable length of time after it is disconnected from the testing source.

Storage batteries are used for heating the filaments of the tubes, although these are usually heated from separate windings contained in the testing transformer. The use of the storage batteries, however, reduces the first cost of the equipment. As each of these small storage batteries is at the high potential above ground, viz., the same potential as the tube, it is necessary to set the storage battery on insulating supports.

There are three separate connections which can be made with the tubes and transformer. The first connection is the normal testing arrangement giving the maximum

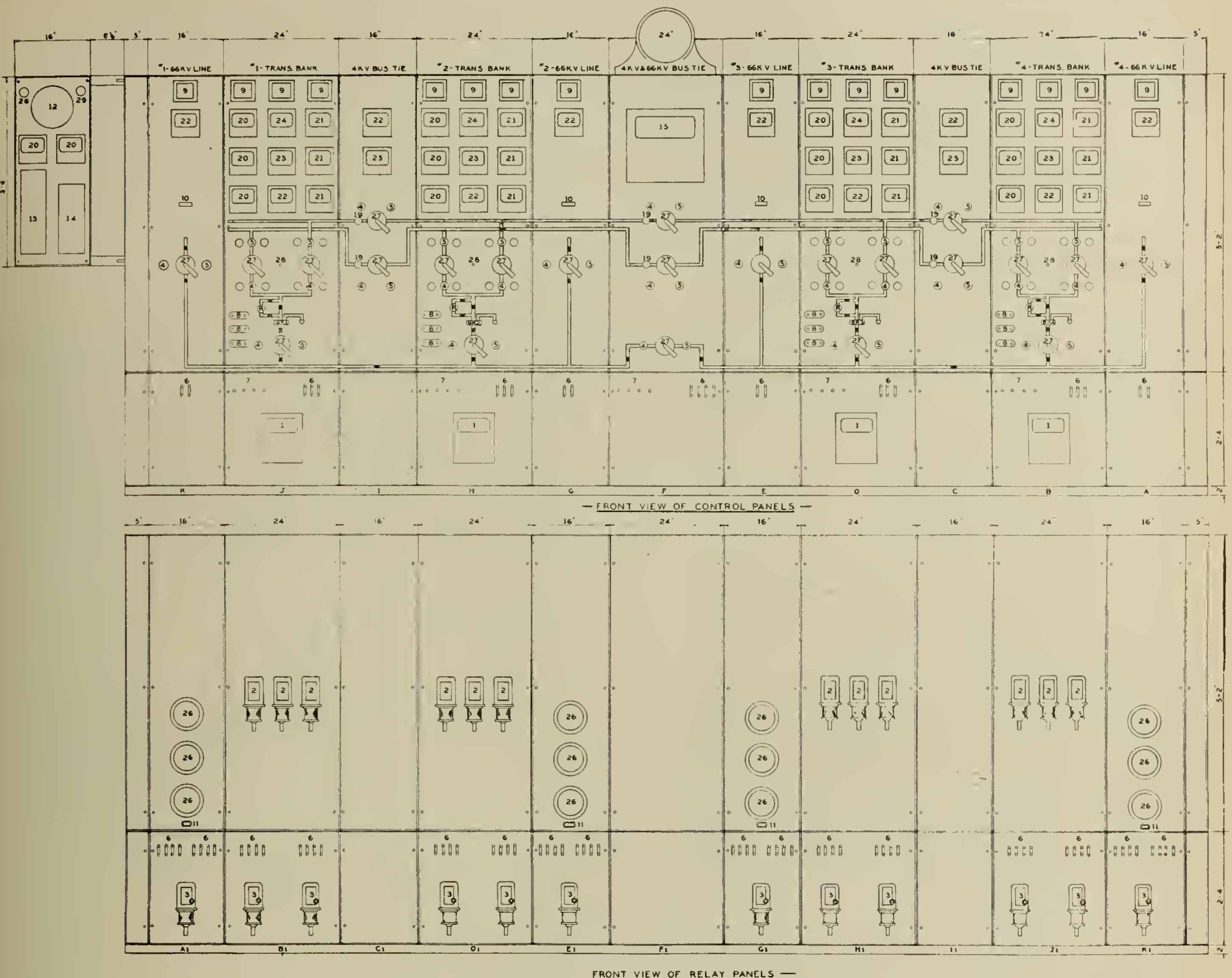

Figure No. 10.—Future Arrangement of 66-Kv. Switchboard.

No.
1 5-amp., 110-v. D56 Polyphase Watthour Meter
2 S.P. Time Limit Relays P.Q. 29
3 S.P. Instantaneous Relays P.Q. 6
4 Green Indicating Lamps with Receptacles
5 Red Indicating Lamps with Receptacles
6 Current Test Links
7 Potential Studs
8 Regulator SWS.
9 Signal Lamps
10 Name Plates

No.
11 Card Holders
12 110-v., 60-M3 Synchronism Indicator
13 18 Pt. Interlocked Push Button V/M SW.
14 12 Pt. Interlocked Push Button V/M SW.
15 Totalizing Meter
16
17
18
19 Synchronizing Receptacles
20 150-v. Voltmeter. Type 496.

No.
21 5-amp., ammeter. Type 496, 4,000 amp., 5-1-5 Scale
22 5-amp. ammeter. Type 496, 600 amp., 5-1-5 Scale
23 5-amp., 210-v. P.F. Meter. Type 497, 5-1-5 Scale
24 5-amp., 120-v. Indicating Wattmeter, Type 499, 24,000 KW. Scale
25 Frequency Indicator. Type 502, 50-70.
26 Pilot Wire Relays
27 Control SWS.
28 D.P. Push Button Interlocking SWS.
29 Indicating Lamps

voltage of 225 kv., and a current of five milliamperes. The next connection reduces the voltage to 75 kv., and increases the available current capacity to 500 milliamperes. The next connection reduces the maximum potential to 37½ kv. and increases the available current capacity to 1,500 milliamperes. Intermediate voltages can be obtained by means of a voltage regulator in the low tension side of the transformer. This large range for potential and current is necessary as it is found from past operating experience that failures occurring on cables of this class usually consist of faults of such high resistance that they cannot be detected by standard fault locating apparatus. It is therefore necessary to first reduce the resistance of the fault. This is done by passing through the fault, for a considerable length of time, a current increasing from about ¼ to 1 ampere, which current burns or carbonizes the insulation at the point of failure of the cable, thereby reducing the resistance of the insulation at that point.

There has not been any occasion, as yet, to use this latter function of the testing set, as there has not been a failure of a 66-kv. cable. Each cable successfully withstood the test of 218,000 volts d.c. for fifteen minutes.

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Henry King Wicksteed, M.E.I.C.

On another page of this issue there appears a memoir containing a brief biographical sketch of the life of one of The Institute's early members, the late Henry King Wicksteed, M.E.I.C., a man admired and loved by all who knew him; whose devotion to his profession, for the sole reason *he loved his work*, brought the reward he desired—*lasting monuments of work well done*, and whose work as a pioneer has earned for him a place among the great men of the profession.

In a special article written by Mr. Wicksteed at the request of the president of the American Association of Engineers, which was printed in the July 1926 issue of the Association's monthly publication *Professional Engineer*, in which he gives an outline of his earlier work, he frequently diverges from his subject to record some incidentals to his training which he considered of great importance to the success of his professional career, and in the concluding paragraph of the article he offers the following advice, to which considerable thought might well be given, particularly by the younger men in the profession and by those who may be called upon to direct the future course of study of the young men of the coming generations:—

"Don't go into engineering unless you feel drawn to the work for its own sake and your pride in it. You and the profession,—any profession,—will both be degraded if you practise it merely for the sake of the money you can make out of it.

"In planning an education, study your own bent of mind, or ask some friend to study it for you, and choose such as will develop most the talents you already possess, but, on the other hand, let the general education be a liberal one, and, above all, include a training in writing and speaking English correctly and forcibly. Many a man of genius has been handicapped by being unable to express his ideas clearly and concisely.

"In the above, one of the shortcomings of a university training has been pointed out, as the writer sees them, a failure to teach the *humanities* and the relations of man to his fellows.

"Another which, until recently at any rate, has been greatly disregarded is that of *economics*. As a young man, the writer was and is still shocked to find how many of his colleagues thought only of spending as much money on work as they could lay hands on,—'building for posterity' was sometimes urged as an excuse. Posterity sometimes rises up and curses them for the legacy of debt and taxation they have left behind, as most engineering works should pay for themselves and their upkeep by their utility and convenience. If they do not, they have no right to exist at all."

Membership in The Engineering Institute of Canada

There are no doubt many engineers who are qualified for admission to The Institute, but who do not apply because they are already members of some other technical society, and fail to see the desirability of adding another to their list of memberships. They probably have not formed any definite mental picture of The Institute and its purposes, and our members, when discussing The Institute with these men, may sometimes find it difficult at a moment's notice to marshal the arguments or replies which would serve to change their point of view; further, our members themselves are not always so familiar as they should be with the history and achievements of The Institute.

Rather more than forty years ago, as a result of a feeling that there should be some corporate body to unite Canadian engineers of all branches of the profession, local committees of engineers were formed in Toronto, Ottawa and Montreal to investigate the possibility of forming an engineering society, and as a result of their combined deliberations the Canadian Society of Civil Engineers was founded and incorporated in June 1887.

In accordance with old usage the term "civil engineer" was intended to include engineers of all branches other than military, but as time went on the name thus adopted for the Society led to some misconception as to the Society's aims, and after some thirty years of healthy development it was felt that the usefulness of the Society would be enhanced if some modifications were introduced in its name, constitution and policy.

In April 1918 parliamentary authority was obtained for a change of title to "The Engineering Institute of Canada." The policy of establishing branches throughout the country, commenced under the former régime, was considerably extended, The Engineering Journal was founded as the organ of The Institute, important modifications were made in the constitution and by-laws, and a period of rapid growth and development at once set in.

Our organization in fact proved a great success, and the membership has grown from about three thousand in 1918 to approximately five thousand. The frequency and activity of meetings, both general and local, has greatly increased, and there has been a marked development in the esprit de corps of the members and in the prestige of the engineering profession in Canada. These and other results bear witness to the soundness of the new policy initiated in 1918. The decentralized organization of The Institute is one of its most interesting features; the branches function individually with a large degree of autonomy, and this permits them to adapt themselves to local conditions without sacrificing the essential unity required in a Dominion-wide body representing the interests of the profession as a whole.

It is interesting to note that the movement towards registration of practising engineers first obtained effective recognition in the province of Quebec, where in 1909 an act governing the practice of the profession was passed, largely as a result of the efforts of the Canadian Society of Civil Engineers. This act was, in fact, the forerunner of those which now exist in other provinces, nearly all of which are based on a model act drawn up by a committee appointed by the Council of The Institute in 1919. It was, of course, recognized that enactments dealing with the admission to practice of engineers in Canada are a matter for provincial and not for federal legislation, and such legislation was obtained in 1920 in Nova Scotia, New Brunswick, Manitoba, Alberta and British Columbia, and in 1922 in Ontario; in the same year the Quebec Act underwent important amendment.

Owing to the changes insisted upon by the various legislatures, the acts now in force differ materially, with the result that the seven provincial professional associations lack uniformity in policy and in qualifications for admission to such an extent that so far complete reciprocity in membership privileges has been found impossible. They are alike, however, in that their primary purpose is to regulate the practice of the profession by engineers, thus preventing undertrained and incompetent persons from representing themselves as qualified professional engineers. It will be understood that this object does not bring the associations into conflict with The Engineering Institute, for they are constituted to carry out a definite provincial task, distinct from the functions of The Engineering Institute as a Dominion-wide body concerned primarily with the dissemination of professional knowledge, the co-ordination of the activities of its members and the privileges and responsibilities of the engineering profession throughout the country.

It is gratifying to note that The Institute's members have always taken a leading part in the work of the professional associations. The relationship between the various fessional associations presents administrative questions of peculiar difficulty, as it is important that the task of these bodies should not be rendered any more difficult by any clash of interests or interference or overlapping of their several fields of work. These and other problems, such as uniformity in requirements for admission to the several associations and to The Institute must be gradually worked out and solved before the organization of the engineering profession in Canada can be regarded as approaching completion. It need hardly be stated that the Council of The Institute is ready and anxious to give any possible assistance in this important task.

Having outlined the present condition of the relationships of the various engineering associations in Canada, the question may be raised as to why membership in The Institute, which is of course entirely voluntary, should be undertaken by an engineer in addition to his membership in the provincial association of his province, to which he is legally required to belong.

In dealing with the activities and interests of engineers in Canada, geographical difficulties and local divergencies in viewpoint are the source of many of our troubles; the vast extent of the country, the long distances separating its component parts, the many varieties of climate, the difference in staple industries, and in the conditions of living existing in different provinces all tend to develop a local rather than a broadly Canadian outlook.

The conditions under which our members work are also very diverse, as will at once appear on comparing, for example, the work of a consulting engineer with that of his confrere in the employ of a large corporation, or the work of a mechanical or electrical designing engineer in the east with that of an irrigation or highway engineer in the west. If effective unity is to be maintained, there is evidently need for an organization embracing all these men, helping them to keep in touch with each other, make each other's acquaintance at general meetings, and have a sympathetic understanding of each other's problems and achievements. It is in this way that The Institute has developed a body of engineers with a Canadian rather than a local point of view, an achievement which would be obviously impossible for any provincial organization. It is evident that such a body, if it is found necessary to make representations on matters affecting the interests of the profession at large, would be able to do this with far more force and effect than any provincial or local organization.

The Institute has done valuable work in promoting the professional interests of its members by another method, and is raising the profession in public esteem by the enforcement of uniform and high requirements for admission, these being based on sound principles of education and training. This policy has been pursued steadily by successive Councils, and its result as time goes on is to make corporate membership in The Institute a recognized indication of professional and technical standing, which is in effect not only all over the Dominion, but also in Great Britain and the United States. It may be mentioned that a movement has just been commenced looking to the ultimate establishment of uniform requirements for admission by examination to The Institute and to the professional associations. This, when successfully completed, will contribute materially to the same end.

The general meetings of The Institute, and particularly its general professional meetings, afford to its members unrivalled opportunities of presenting and discussing papers on professional subjects of which they have special knowledge; in addition to this, such meetings bring the profession and its work most effectively before the public. The prestige and standing of members of the engineering profession in the city of Quebec for example cannot fail to have been enhanced as a result of the well attended and dignified Annual General Meeting recently concluded in that city.

The papers presented and discussed at the general meetings form a record of the achievements of Canadian engineers, and the interchange of professional experience and information which takes place on these occasions is one of the principal objects of The Institute's existence. Similar benefits, of course, accrue from the technical activities and meetings of our twenty-five branches and apply particularly to those members who take the trouble to prepare papers or participate in discussion.

The Engineering Journal since its establishment nine years ago has had a marked effect in consolidating The Institute, keeping the various branches in touch with one another regarding the work and activities of the branches and of The Institute as a whole, and giving effective publicity to professional papers and matters affecting the profession. The Journal is the organ of The Institute's members, who contribute its contents, and it reflects from day to day what the five thousand engineers in Canada are doing and thinking.

As has already been pointed out, The Institute is able to deal with important questions affecting the engineers in a manner which is not possible for any body having more limited scope as regards membership. This is shown by the work of The Institute Committees, particularly during the past five years.

In March 1920 a Committee on Classification and Remuneration of Engineers was constituted by a resolution of Council, and reported in 1922. Its findings, arrived at after two years' active work, were based on reports from the various branches of The Institute as well as information obtained from other engineering societies and the technical press, and other sources, and they outlined a scheme of classification of engineering fees, rates of remuneration and schedules of salaries of fees which has proved of invaluable service in indicating to employers, governmental and other organizations, and to the public, a fair and logical schedule on which engineers' fees and salaries should be based.

Notable public service was rendered by The Institute's Fuel Committee, which was appointed in April 1923 to report upon the fuel question in Canada, and carried on its work in consultation with the Dominion Fuel Board and the Canadian Institute of Mining and Metallurgy. Its report issued in 1924 placed in a clear light the possibilities as regards:

1. Sources of fuel for Canada for eastern, central and western regions.
2. Utilization of Alberta coals as far east as Ontario.
3. Fuels available as substitutes for American anthracite.
4. The co-ordination of water power and fuel development.

This report did much to create a well informed body of opinion among the members of The Institute, thus forming a nucleus for the education of the public in general on this vital question.

The adoption of a Code of Ethics by the membership of The Institute in 1924, after thorough investigation by a committee appointed for that purpose, affords another example of the way in which a representative body like The Institute can aid its members by establishing well thought-out standards. Questions of professional ethics are amongst the most difficult with which our Council has to deal, and a clear concise statement of the many particulars involved is a necessity. Such a statement is also the first requisite in building up a high level of professional conduct, and it is given by the Code of Ethics.

The notes given above do not exhaust the list of matters of general interest with which The Institute concerns itself. The problem of engineering education and the relation of The Institute with the engineering schools of the universities, opportunities and facilities required for the training of young engineers after graduation, relations between The Institute and professional associations, the encouragement of a wider and more active interest on the part of members in Institute affairs, the future developments and progress of The Institute, the extent to which it is advisable that The Institute should endeavour to guide public opinion by making declarations on matters of public policy, constitute some of the questions now receiving attention.

Note should be made of the services rendered by The Institute to its individual members. In addition to the facilities afforded by the meetings and publications of The Institute, the information service at Headquarters, exemplified by the publication in the Journal of the Engineering Index with its arrangements for supplying technical books and data to members, is largely utilized. Further, the employment bureau is a very great benefit, dealing as it does with approximately seven hundred applications a year, and has commended itself not only to individual members but also to a large and increasing number of employers.

In discussing an organization like The Engineering Institute, and the reasons for belonging to it, the thought presents itself, "What do I get out of it?" Such an attitude of mind on the part of an enquirer is very natural and proper, provided that he goes one step further and realizes that if every member of such an association takes a purely passive attitude and waits the arrival of expected benefits they will never materialize.

The results attained by The Institute and the benefits to be derived from membership in it are due entirely to the active and unselfish labour of its individual members, and those who get most out of The Institute are those who contribute most by giving their time and energy in its service, whether by taking an active part in general or branch meetings, by discussing papers, serving on committees, or in other ways perhaps less prominent but equally useful. There is every reason to anticipate that with the co-operation and aid of our members the rapid development of the last five years will be continued and the results consolidated, and in the years to come The Institute will exert an ever-widening influence as the national engineering society of Canada.

OBITUARY

Henry King Wicksteed, M.E.I.C.

In the death of Henry King Wicksteed, M.E.I.C., which occurred at Toronto, Ont., on July 23rd, 1927, The Engineering Institute of Canada has lost one of its earliest members and one who through his unfailing interest in its welfare and his sound counsel has served it well for many years.

His passing has removed from the ranks of the engineering profession one whose record of unselfish devotion to his work in the development of our country upholds the highest traditions of the profession. Endowed with a superabundance of human sympathy, a genial nature and a love for pioneering which led him into many fields, he had a host of friends and was loved by all.

Born at Quebec City on May 25th, 1855, the late Mr. Wicksteed received his primary education in that city and at Morin College, and, on completing his matriculation in 1870, he entered the engineering course at McGill University, from which he graduated in 1874. During the summers of his university course he was engaged in a junior capacity in preliminary railway surveys, and immediately following graduation he was employed on exploration work between lake Superior and Rainy lake for the Canadian Pacific Railway. He was soon made leveller, then transitman, and, after a winter in the office at Ottawa, in 1875, he was appointed chief assistant to the district engineer on construction and maintenance at Port Arthur.

Construction work did not appeal to him as did surveying and location, so that when construction was finished at Winnipeg he branched off into municipal work for a year or more. About this time he entered into partnership with Mr. A. L. Russell, of Port Arthur, and was engaged in land surveying and general engineering, and among other works they completed and published the first map of Port Arthur.

In 1882, after many surveys had been made for the line of the Canadian Pacific Railway eastward from Fort William and the route along the lake Superior shore had been condemned as impracticable and the alternative route north of lake Nipigon was contemplated, Mr. Wicksteed was entrusted with a final investigation of the section from Jack Fish bay to Pie river. After two seasons' work, the lake shore route was decided upon and the proposed grades reduced from one and one-half per cent to one per cent and the aggregate tunnelling from five miles to fifteen hundred feet following Mr. Wicksteed's recommendations. He resigned from this work on account of his health in 1884 and in the following year the line was completed.

During the winter of 1885 he made an exploratory trip for the Canadian Pacific Railway along the Etchemin river, from near the present city of Levis across the northern part of the state of Maine to Woodstock, N.B., and later in the same year he returned to Port Arthur. He was instructed to make a reconnaissance survey of a proposed railway from Winnipeg to Hudson's bay but this was abandoned and in 1886 he was appointed chief engineer of the proposed Port Arthur, Duluth and Western Railway, another enterprise which was later stopped due to lack of financial support.

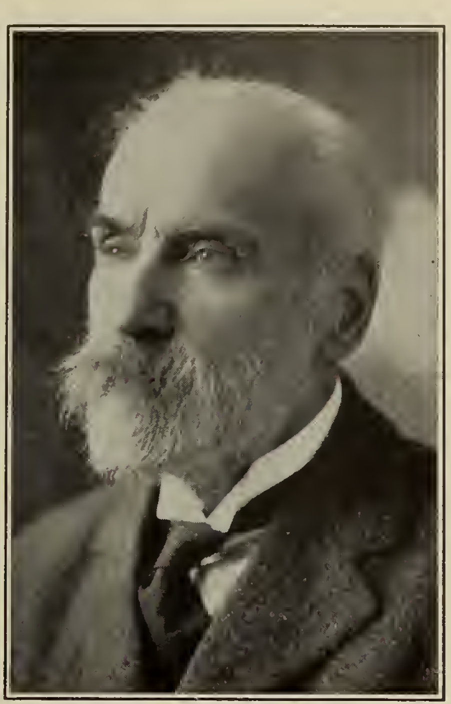
In the autumn of 1887 he was appointed chief engineer of The Brantford, Waterloo and Lake Erie Railway (now part of the Toronto, Hamilton and Buffalo Railway), on which work he was engaged for two years.

From 1890 to 1900 he was engaged on various works including the double tracking of the Grand Trunk Railway from Montreal to Toronto; the Soulanges canal; the location of a line from Sarnia tunnel to the Great Western Air Line at Glencoe for the Grand Trunk Railway, and work for the same company in anticipation of double tracking the line between Hamilton and Niagara Falls; and location of the proposed Nipissing and James Bay Railway.

In the summer of 1899 he joined the staff of the Canadian Northern Railway, his first work being in Nova Scotia on the Inverness and Richmond and the Halifax and South Western Railways during the years 1900 to 1902, and in 1902 he became chief engineer on the James Bay Railway during which time the Toronto-Sudbury section was constructed. Later, in 1904, he was appointed chief engineer of location and surveys for the entire northern system, which position he held for about twenty years. His work during this time took him to practically every province in the Dominion and up to the year 1914 he located about 2,000 miles of railway including the entrances to Quebec, Montreal (the tunnel beneath Mount Royal) and Toronto. Other sections located by Mr. Wicksteed during this period included Ottawa-Hawkesbury in 1905; Ottawa-French River to Nipissing Junction, Garneau-Quebec cut-off, and Montreal-Hawkesbury in 1906; Key branch to Georgian bay in 1906-07; Toronto-Ottawa and St. Jerome-St. Eustache in 1907-08; Sudbury-Port Arthur during 1908-11; Toronto-Niagara Falls and Ottawa-Capreol in 1911-12; Mount Royal tunnel, Rawdon branch, Huberdeau-St. Remi and Toronto-Bowmanville during 1912-14.

During the years 1914 and 1915 Mr. Wicksteed was in Venezuela, where he located about 175 miles of railway from a coal mine in the interior to the coast, for Messrs. McKenzie and Mann. On returning to Canada, during the years 1916 to 1918 he was engaged on revising and extending lines in Ontario and Quebec for the Canadian Northern Railway and on surveys of coal fields at Rosedale, Alta., for Messrs. McKenzie and Mann.

Following the taking over of the Canadian Northern Railways by the federal government he remained with the new organization until 1921 when he resigned. That year he went to Brazil where he carried out surveys for a proposed railway and harbour improvements at Sao Paulo for the Brazilian Development Company.



HENRY KING WICKSTEED, M.E.I.C.

Until a short time prior to his death, Mr. Wicksteed was actively engaged on work of an exploratory nature. A few years ago he became greatly interested in the possibilities of aerial surveying as a means of carrying out railway reconnaissance and at the first opportunity journeyed to Grand'Mère, Que., to personally investigate its feasibility by a series of flights. Upon being satisfied as to the results that could be obtained he used this means for preliminary surveys on subsequent work on which he was engaged; which included a reconnaissary survey in northern Quebec for the Abitibi Southern Railway, a project to connect the Rouyn mining field with an existing railway to the south, and in connection with the survey of Hydro-Gatineau-Toronto transmission line. Many stories are told by officers of the Fairchilds Aerial Survey Company of Mr. Wicksteed wishing to fly every day, rain or shine, and wishing to fly *low*, so that he could get good " close up " views.

Mr. Wicksteed's connection with The Institute dates from its earliest days and while his name does not appear on the Charter of The Institute, (originally of The Canadian Society of Civil Engineers), it does appear on the records among the first to become members, as early as January 20th, 1887, five months before the incorporation of the Society. He was actively interested in the affairs of The Institute and particularly the branch in Toronto where he resided of late years. He was elected to the Council of The Institute on two occasions, first in 1908 and again in 1925 and was still a member of Council at the time of his death.

Much more might be written of the truly romantic life of the late Mr. Wicksteed; of his early experiences in the work of advancing civilization in Canada and even of his later work in reconnaissance by aerial survey; many indeed are the stories of real human interest that might be recounted if time and space permitted, but the summation of it all lies in the knowledge that, measuring success by work well done and service to his country and his fellowmen, his life was an outstanding success.

PERSONALS

J. T. Thwaites, S.E.I.C., has joined the staff of the Smart Turner Machine Company, Limited, of Hamilton, Ont., as sales engineer.

G. K. Waterhouse, Jr.E.I.C., has joined the staff of the Lake St. John Power and Paper Company, Limited, and is located at St. Felicien, Que. Mr. Waterhouse graduated from Queen's University in 1919, and has recently been located at Belleville, Ont.

F. K. Beach, A.M.E.I.C., has been transferred to the North West Territories and Yukon Branch of the Department of the Interior and is located at Calgary, Alta. Mr. Beach was formerly with the Dominion Water Power and Reclamation Service of the same department.

H. H. James, A.M.E.I.C., is engineer with the Pittsburgh Plate Glass Company and is located at Zanesville, Ohio. He was previously on the staff of the American Steel and Wire Company at Donora, Pa., prior to which he was for a number of years with the Montreal Locomotive Works in the office of the maintenance engineer.

T. B. Fraser, S.E.I.C., has been appointed to the staff of the Anticosti Corporation and is engineer in charge of work at Anticosti Island, Que. Mr. Fraser was formerly on the engineering staff of the forestry engineering branch of the Wayagamack Pulp and Paper Company, prior to which he was for two years located at New Liskeard, Ont., with Messrs. Sutcliffe Company, Limited.

J. O'Halloran, Jr.E.I.C., has joined the engineering staff of the Anglo-Canadian Pulp and Paper Mills, Limited, Quebec, Que. Mr. O'Halloran has been with Price Brothers and Company at Kenogami, Que., since 1924. He is a graduate of McGill University of the class of 1921, and following graduation he was appointed assistant mechanical engineer with the Abitibi Power and Paper Company, Iroquois Falls, Ont.

J. C. Mews, Jr. E.I.C., is located at Buchans, Newfoundland, as assistant to the construction engineer of the Buchans Mining Company, Limited. Mr. Mews is a native of St. John's, Newfoundland, and was for a number of years with the Nova Scotia Steel and Coal Company at Wabana, Nfld. He was on active service during the late war from 1915 until demobilization in 1919. He was first with the Royal Naval Reserve and later with the Royal Newfoundland Regiment.

E. J. Peal, S.E.I.C., has accepted the position of assistant to the general superintendent of the Dominion Envelope and Carton Company, Limited, at Toronto, Ont., having resigned from the engineering staff of the Canada Sugar Refining Company. Mr. Peal graduated from Queen's University in 1924, and immediately following his graduation he joined the staff of the Bailey Meter Company, Limited, and was located for a year at that company's office in Cleveland, Ohio, subsequently being transferred to the Montreal office.

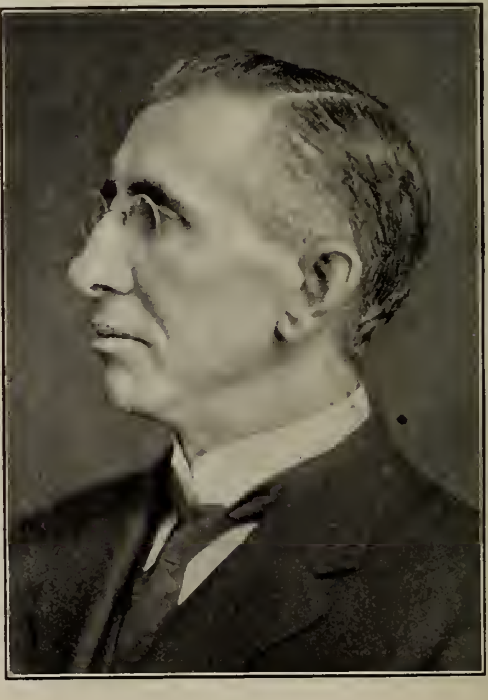
A. C. Turtle, A.M.E.I.C., who for a number of years has been located in Winnipeg, Man., has joined the staff of the Holden Company, Limited, at Montreal, Que. Mr. Turtle was first with the Canadian Pacific Railway Company at their Winnipeg shops until March 1914, following which he was engaged at the Transcona shops of the Grand Trunk Pacific Railway, (later the Canadian National Railways), Company, where he occupied various positions for about twelve years. Subsequently, he was chief engineer of the Western Engineering Company, Limited, at Winnipeg, Man.

T. S. Glover, A.M.E.I.C., has returned from Nigeria, where he has been for the past three years occupying the Colonial Office appointment of assistant engineer in the Department of Public Works. Mr. Glover is a graduate of the University of Toronto, from which he received the degree of B.A.Sc. in 1922. Following graduation he was engaged with Messrs. Fraser Brace, Limited, as assistant engineer on the water power development at Humber Arm, Newfoundland, following which he accepted the appointment which took him to Nigeria.

Victor Topping, A.M.E.I.C., sailed for England early in August in the interests of a railway undertaking in Brazil, in which he had been associated with the late Henry K. Wicksteed, M.E.I.C. Mr. Topping is a graduate of the University of Toronto and has the degrees of M.A., B.A.Sc. and C.E. He is a native of England and came to this country with his parents in 1912. He went overseas with the Royal Flying Corps in 1917, and in the following year met with an accident when his machine took fire and crashed to the ground, which resulted in his being confined to the hospital for four years. Upon returning to Canada he became connected with the Toronto Transportation Commission. Mr. Topping was awarded the first Strathcona Memorial Fellowship for research work in transportation carried on by him at Yale University.

Elected President for Canada of the International Electrotechnical Commission

John Murphy, M.E.I.C., of Ottawa, Ont., was elected president of the Canadian National Committee of the International Electrotechnical Commission at a meeting held in Ottawa laboratories of the Department of Trade and Commerce on July 11th, 1927. Mr. Murphy is the electrical expert of the Railway Commission of Canada and the Department of Railways and Canals, and, as president of the International Electrotechnical Commission, he succeeds the late Mr. James Kynoch, who died on June 1st, 1927. The next plenary meetings of the International Electrotechnical Commission will be held in Italy in September at Como and at Rome, and Mr. Murphy will attend as Canada's official delegate. He will also, in company with Dr. Charles Cam-



JOHN MURPHY, M.E.I.C.

sell, M.E.I.C., deputy minister of mines and chairman of the Canadian World Power Conference Committee, be an official delegate to the World Power Conference, which takes place at Como in September.

Major R. A. Logan, A.M.E.I.C., Now Located in Northern Rhodesia

Major R. A. Logan, A.M.E.I.C., is located in Northern Rhodesia, where he has joined an aerial survey expedition in connection with work in that country. Major Logan was formerly with the Fairchild Aerial Survey Corporation of New York, and prior to sailing for England he spent several months at Middle Musquodoboit, Nova Scotia. He left Canada on June 28th for London, England, where he became associated with the Aircraft Operating Company of London; subsequently, on July 28th, sailing for South Africa.

He is a graduate of Nova Scotia Technical College, from which he received a diploma in 1911, and was also a student at the University of Alberta. His early work was in connection with land surveys in Nova Scotia in 1909, and for the following two years he was engaged on Dominion land surveys in Manitoba and Saskatchewan. In 1914 he was commissioned a Dominion Land Surveyor, and in 1915 he was appointed aeroplane pilot and engineer in the Royal Flying Corps and in April 1917 he became flight commander. Subsequently, he was appointed officer in charge of ground instructional section, Canadian Air Force, Camp Borden, and since September 1st, 1921, has held the rank of squadron leader (major). In 1922 he was engaged on special investigation of flying conditions in the Arctic regions with the Canadian Arctic Expedition of that year. Later he was appointed manager of the mapping division of the Fairchild Aerial Camera Corporation in New York.

Major J. C. Craig, D.S.O., M.E.I.C., Receives Appointment in British Guiana

Major J. C. Craig, D.S.O., M.E.I.C., who recently has been at Aberdeen, Scotland, left early in August for British Guiana to assume the duties in connection with his new appointment as director of public works at Georgetown.

Major Craig originally comes from Aberdeen, Scotland, where he received his early education at Robert Gordon's College. His training in engineernig was obtained as apprentice to Hall Russell and Company, shipbuilders and engineers, Aberdeen, and as apprentice and general assistant to the city engineer of that city. Upon the completion of his apprenticeship he was appointed assistant resident engineer on the Aberdeen sewage works. Three years later he became engineering assistant to the city engineer of Westminster. In 1905 he was appointed resident engineer of the Public Works Department of Straits Settlements, which position he occupied until 1913.

In 1914, Major Craig came to Canada and was on the staff of the Pacific Great Eastern Railway at Vancouver. In the fall of that year he received his commission as lieutenant in the 6th Field Company Engineers, proceeding overseas, where he served with distinction throughout the war. The following year he became captain of the 1st Canadian Pioneers and in 1916 major chief engineer and 2nd in command of the 9th Canadian Railway Troops until September 1918, when he became assistant director of construction, light railway section. He was awarded the Distinguished Service Order and was mentioned in despatches three times. Following the war he remained in the Old Country until his appointment in 1922 as assistant chief engineer, Gold Coast Harbours, with headquarters at Accra. Later he was located at Seccondee, Gold Coast Colony, West Africa.

F. H. PALMER, A.M.E.I.C.

F. H. Palmer, A.M.E.I.C., Accepts Important Post at Antwerp

F. H. Palmer, A.M.E.I.C., has resigned from the Department of Trade and Commerce, Canada, to take an important executive position with the Ford Motor Company at their Antwerp branch in Belgium.

Mr. Palmer has occupied the position as Canadian Trade Commissioner in New York, Rotterdam, Holland, and Milan, Italy, having been appointed to the latter post during 1926. He is a native of Belfast, Ireland, and received his engineering training at Nova Scotia Technical College, from which he graduated with the degree of S.B. in 1913. Following graduation, he was with the Toronto Structural Steel Company, Limited, in their shops at Toronto and later on erection work at Lindsay and Ottawa. During 1915 he was for a short time on building construction in Halifax, after which he was appointed assistant engineer with Foley Brothers, Welch, Stewart and Fauquier on the Halifax ocean terminals. He was on active service overseas from October 1916 until the end of the war, serving as lieutenant in the heavy artillery and being awarded the Military Cross. Following the war he was with the Nova Scotia Highways Commission.

John Stephenson, A.M.E.I.C., Enters Private Practice

John Stephenson, A.M.E.I.C., has entered private practice as designing engineer and has opened an office in Hamilton, Ont., where he will undertake the designing, estimating, supervising of new work and the reconstruction and reconditioning of old plants, machinery, etc.

Mr. Stephenson has had a wide experience in work of this nature. From 1911-1919 he was with the Nova Scotia Steel and Coal Company, occupying various positions, including draughtsman, foreman of heat treating plant and designing, and was also engaged on efficiency work. In February 1919 he was located at Halifax, N.S., as draughtsman and engineer on the new shipyard with the Halifax Shipyards, Limited. At the end of that year he joined the staff of the Algoma Steel Corporation, Limited, at Sault Ste. Marie, Ont., in a similar capacity, being employed on the design of the company's rail and structural mills. In May 1920 he returned to the Nova Scotia Steel and Coal

Company and was located at Sydney Mines, N.S., where he was engaged on designing and engineering in connection with steel plant and coal mining machinery. He remained with this company until 1922, when he accepted a position with the Bethlehem Steel Company in charge of mill construction engineering which included a large variety of work in connection with the company's mills. He remained there until 1924, when he was transferred to the company's works at Lackawanna, N.Y., where he remained until 1925, resigning to accept the position of designing engineer with the Carnegie Steel Company at Munhall, Pa. Subsequently, he became connected with the Detroit Edison Company at Detroit, Mich.

EMPLOYMENT BUREAU

Situations Vacant

CIVIL ENGINEER

A paper company in the province of Quebec requires a recent graduate in civil engineering for their operating staff of the woodlands department. Apply Box No. 169-V, Engineering Journal.

RADIO ENGINEER

A manufacturing company located in the Toronto district requires a graduate engineer for radio broadcast receiver design. Please give full particulars of education, experience and salary expected. Apply box No. 170-V, Engineering Journal.

MECHANICAL ENGINEER

Young mechanical engineer with some experience in industrial work to act as assistant to the chief engineer. Salary $150.00 per month. Location western Ontario. Apply Box No. 171-V, Engineering Journal.

DESIGNING ENGINEER

Good practical hydro-electric designer, one having experience in design of dams, penstocks and the substructure of power houses. Apply Box No. 172-V, Engineering Journal.

Recent Additions to the Library

Proceedings, Transactions, etc.

PRESENTED BY THE SOCIETIES:

The Canadian Institute of Mining and Metallurgy: Transactions 1926.
The Mining Institute of Scotland: Transactions.
The World Power Conference, Sectional Meeting, Basel: Transactions 1926, volumes 1 and 2.
The Institute of Water Engineers: Transactions 1926.
The American Society of Mechanical Engineers: Gib Head Taper Stock Keys, 1927; Plain Taper Stock Keys, 1927; Wrench, Head Bolts and Nuts and Wrench Openings, 1927; F-Slots, their Bolts, Nuts, Tongues and Cutters, 1927; Power Test Codes, Series 1923; Steel Pipe Flanges and Flanged Fittings.
The Royal Philosophical Society of Glasgow: Proceedings 1925-1926.
The Royal Society of Edinburgh: Proceedings 1926-1927.
The Royal Society of Canada: Proceedings and Transactions 1926.
The American Concrete Institute: Proceedings 1927.
The Highway Research Board: Proceedings.
The American Society of Civil Engineers: Year Book 1927.
The American Society for Testing Materials: Annual Report of the Executive Committee, 1927. (Reprint.)
The Franklin Institute: Year Book, 1927.
The Institute of Engineers, Australia: Electric Wiring Rules.
The Societé des Ingénieurs Civils de France: Year Book, 1927.
The British Engineering Standard Association: Indexed List of British Standard Specifications and Reports, 1927.

Reports, etc.

DEPT. OF THE INTERIOR, CANADA:

Dominion Water Power and Reclamation Service: Water Resources Paper No. 51; Annual Report 1925-1926.

Natural Resources Intelligence Service; List of Publications; Les Resources Naturelles de Québec.

DEPT. OF TRADE AND COMMERCE, CANADA:

Bureau of Statistics: The Canada Year Book, 1927; Census of Industry, 1925; Canal Statistics, 1926; Summary of Trade in Canada, 1926-1927.

BUREAU OF STATISTICS, QUEBEC:

Statistical Year Book, 1926.

DEPT. OF NATIONAL DEFENCE, CANADA:

Report on Civil Aviation, 1926.

DEPT. OF RAILWAYS AND CANALS, CANADA:

Highway Branch: Highways, Motor Vehicles and Tourists in Canada. Circular 8.

DEPT. OF MINES, CANADA:

Mines Branch: Abrasives, Part 2 and 3.

SENATE OF CANADA:

Proceedings of the Special Committee on Fuel Supply in Canada. No. 15.

DEPT. OF MINES, ONTARIO:

Annual Report, 1926.

NOVA SCOTIA POWER COMMISSION:

Annual Report, 1926.

DEPT. OF GEOLOGY, UNIVERSITY OF ALBERTA:

Scientific and Industrial Research Council: Geology along the Bow River. Report 17.

AERONAUTICAL RESEARCH COMMITTEE, (BRITISH):

Reports and Memoranda. Nos. 1046-1062.

IRRIGATION OFFICE, BAGHDAD, INDIA:

Irrigation Directorate Iraq, Administration Report.

DEPT. OF COMMERCE, UNITED STATES:

Bureau of Standards: Thermal Expansion of Graphite, Tech. Paper 335; Comparative Tests of Six-Inch Cast Iron Pipes of American and French Manufacture, Tech. Paper 336; Sound Proofing of Apartment Houses, Tech. Paper 337; Electrodeposition of Chromium from Chromic Acid Baths, Tech. Paper 346; Determination of the Magnetic Induction of Sheet Steel, Sci. Paper 545; Magnet Reluctivity Relationship, Sci. Paper 546; Wave Length Measurements in the Arc and Spark Spectra of Zirconium, Sci. Paper 548; Wave Length Measurements in the Arc Spectrum of the Scandrum, Sci. Paper 549; Specifications for Portland Cement, Circular 33; United States Government Specifications for Cement, Plastic Magnesia used for Flooring, Bases, Wainscots, Circular 323; Ceramic Properties of some White-Burning Clays of Eastern United States, Circular 325; Directory of Commercial Listing and College Research Laboratories, Miscell. Publ. 90; Safety Rules for Installation and Maintenance of Electrical Supply and Communication Lines, Handbook 10; List of Publications, May 1927.

Bureau of Mines: Ventilation of Vehicular Tunnels; Experimental Studies on the Effect of Ethyl Gasoline and its Combustion Products, Resistance of Metal Mines Airways, Bulletin 261; Technology and uses of Silica and Sand, Bulletin 266; Acid Process for the Extraction of Alumina, Bulletin 267; Coal Dust Explosion Tests in the Experimental Mine, 1919-1924, Bulletin 268; Summary of Mineral Production in Foreign Countries, 1920-1925; Iron Blast-Furnace Reactions, Tech. Paper 391; Precipitation of Gold and Silver from Cyanide Solution of Charcoal, Tech. Paper 378.

TREASURY DEPT., UNITED STATES:

Public Health Service: Report on Municipal Sanitary Engineering Practice in Great Britain, Bulletin 166.

COAST GEODETIC SURVEY, UNITED STATES:

Bibliography Bulletin of Eastern Section of the Seismological Society of America.

Technical Books, etc.

PRESENTED BY D. VAN NOSTRAND CO.:

Eminent Chemists of our Time, by Benjamin Harrow.
Handbook of Engineering Mathematics, by W. E. Wayne and Wm. Spraragen.

PRESENTED BY CHAPMAN & HALL:

The Metallurgist's Manual, by T. G. Bamford and H. Harris.
The Working of Aluminum, by Edgar T. Painton.

PRESENTED BY MCGRAW-HILL BOOK CO.:
Superpower, by Wm. S. Murray.

PRESENTED BY MCGILL UNIVERSITY:
McGill Honour Roll.

PRESENTED BY G. P. HAWLEY:
State Board of Health of Massachusetts upon the Purification of Sewage.

BRANCH NEWS

London Branch

Frank C. Ball, A.M.E.I.C., Secretary-Treasurer.

ANNUAL INSPECTION TRIP

Following the established custom of the London Branch in having a tour of inspection to some large engineering work each summer, the branch executive planned a motor trip to the new Peace bridge on Saturday, August 6th. This date, suggested by the chairman, was chosen in order to combine the official opening of the bridge, on Sunday, with a more detailed inspection from an engineer's standpoint.

The members of the party are greatly indebted to C. H. Scheman, A.M.E.I.C., general manager of the Horton Steel Works, Limited, at Bridgeburg, chairman of the Niagara Peninsula Branch, who arranged the details of the trip at the Bridgeburg end and whose hospitality was much appreciated.

The party left London at 7.00 a.m. by motor car and had lunch at Erie Beach hotel, at noon. The afternoon started with an inspection trip through the plant of the Horton Steel Works. Although Saturday afternoon is a slack afternoon in the plant there were many things of interest to be seen. The members saw some large high pressure tanks under construction and were specially interested in the method employed in galvanizing such tanks by the use of the oxy-acetylene flame.

Following this, the party motored on to the Peace bridge, where cars were parked during the inspection of the bridge. For dinner in the evening the entire party was entertained by Mr. Scheman at the Buffalo Athletic Club. From this time on the members of the party were free to go and come as they pleased and found much pleasure in following Mr. Scheman's suggestions for amusement at Erie Beach and Crystal Beach or at the Niagara Falls or Buffalo.

An interesting event at Erie Beach, and of which some of the members availed themselves, was the staging of an historic pageant in the stadium which portrayed important events in the history of Canada from the days of the Indian occupation up to the present time.

On Sunday each motor party arranged its own itinerary, to include points of interest in the Niagara Peninsula and the official opening of the Peace bridge in the afternoon at which H.R.H. The Prince of Wales, and H.R.H. Prince George, Premier Baldwin, and many other internationally-known personages were present.

The return trip to London was made in the evening, with all members well pleased with the two-day outing.

Ontario Professional Engineers Visit Northern Mining District

A party of twenty members of the Association of Professional Engineers of Ontario recently completed a week's trip through the northern Ontario mining district. The party travelled by special compartment car, which was dropped off on sidings at various points by special arrangement with the Temiskaming and Northern Ontario Railway.

The first day of the trip was spent at Sudbury, where the engineers were the guests of the International Nickel Company and the Mond Nickel Company. Messrs. J. W. Rawlins and E. A. Collins, councillors of the association, were in charge of the Committee of Arrangements. All of the engineers were taken underground to the 2,600-foot level in the Creighton mine, after which they were taken through the International Nickel smelter and were the guests of the company at lunch at the Club House. After lunch, the party drove to the Frood mine, which has recently been the subject of so much interest, and from there were taken to the Mond Nickel plant at Coniston. Returning to Sudbury, the party visited the office of Mr. R. W. Demorest, which was closed for business but by special arrangement was opened to the engineers.

At Cobalt, on the following day, the party was met by E. V. Neelands and other members of the association at Cobalt. They divided into small groups with separate guides, and in this way the party was taken around the various Cobalt mines, and particular attention was given to the Nipissing low grade mill and refineries.

The party entrained again at mid-afternoon at Haileybury, and, arriving at Kirkland Lake at 6.30 p.m., was met by Mr. D. L. H. Forbes of the Teck-Hughes gold mines, a member of Council. The party was driven to Mr. Forbes' home on the shore of Kirkland lake, where all of the mining managers of the district were gathered, and after a pleasant half-hour of greeting the party had dinner at the Teck-Hughes Club. The following day, the engineers inspected the milling plants of the Teck-Hughes, Lake Shore, Wright Hargreaves and Sylvanite companies, after which the party was divided into groups and taken underground in one or other of the mines.

At Timmins, the party was met by engineers of the McIntyre Porcupine Company and were guests of that company for dinner. After dinner, the golf enthusiasts of the party had the unique experience of playing until 10.30 at night, daylight saving time.

The following day was taken up by an inspection of the Hollinger and McIntyre mills, with a further trip underground at Hollinger. Considerable interest was taken in the new 4,100-foot shaft now being completed at the McIntyre plant.

The last day of the trip was spent on lake Temagami. The party went by boat to the Temagami Inn for lunch, where guides were provided for a few hours of fishing,—by special request, mention is omitted of the number and size of fish caught.

From the beginning to the end of the trip the party was favoured with wonderful weather, and they were the recipients of long to be remembered courtesy at every point. The complete success of the trip brought forth strong recommendations in favour of establishing an engineering trip of this nature as an annual institution.

The Forty-second

ANNUAL GENERAL *and* GENERAL PROFESSIONAL MEETING

of THE INSTITUTE

to be held in MONTREAL, QUE.

The Annual Meeting will be convened at Headquarters,

January 19th, 1928,

at 8.00 p.m.,

for formal business, and will be adjourned to

February 14th, 15th & 16th, 1928

Institute Committees for 1927

FINANCE

J. H. Hunter, Chairman
J. L. Busfield
F. P. Shearwood
K. B. Thornton
O. O. Lefebvre

LIBRARY AND HOUSE

W. C. Adams, Chairman
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CANADIAN ENGINEERING STANDARDS

C. J. Mackenzie (three years)
C. M. McKergow (two years)
J. M. Oxley (one year)

HONOUR ROLL AND WAR TROPHIES

Brig.-Gen. C. J. Armstrong
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Arthur Surveyer
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ENGINEERING EDUCATION

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S. G. Porter

Preliminary Notice

of Applications for Admission and for Transfer

August 18th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in September 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science or engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BACKMAN—WALTER HENRY, of Gatineau, Que., Born at Lunenburg, N.S., Jan. 26th, 1901; Educ., B.Sc., N.S. Tech. Coll.; 4 mos. surveying, N.S. Highways Board; two and a half years' electrical engrg. with Shawinigan Water & Power Co. and Shawinigan Engrg. Co.; for past eight months, cost engrg., Fraser Brace Engrg. Co., Ltd.

References: D. W. Munn, H. Donkin, F. R. Faulkner, K. L. Dawson.

SPENCER—RAYMOND A., of Walkerville, Ont., Born at Meriden, Conn., Oct. 23rd, 1885; Educ., B.Sc., Univ. of Vermont, 1908; 1909-10, field supt., Peterson Lake Mining Co. at N.S. Mining Co., Cobalt, Ont., i/c several leased mines; 1910-12, cost keeper and asst. to supt. during constrn. of cyanide mills, i/c underground surveying and design and detail of plant and equipment for original cyanide mills for Hollinger Gold Mines under supervision of A. G. Kirby; 1912 to date, with Can. Bridge Co., as follows: 1912-14, detailing bridge work, transmission towers, etc.; 1914-19, design and estimating of all types of steel framework; 1919-Apr. 1927, i/c estimating dept. and asst. to contracting engr., also i/c plant inventory and appraisal; at present, contracting engr.

References: G. F. Porter, C. M. Goodrich, W. H. Baltzell, C. P. Disney, M. B. Atkinson, C. S. L. Hertzberg, H. Thorne.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

TEMPLEMAN—GEORGE EARL, of Montreal, Que., Born at Waubaushene, Ont., June 26th, 1879; Educ., S.P.S., Toronto, 1896-97; 1900-02, general operating experience on hydro-electric and transmission lines in B.C.; Jan. to Oct. 1903, direct current testing dept. of Western Electric Co., Chicago; 1903-04, alternating current test work, C.G.E. Co., Peterborough, Ont.; 1904-12, Allis-Chalmers, Bullock, Ltd., as follows: 1904-07, erecting engr.; 1907-08, gen. foreman of testing and winding depts.; 1908-10, supt. of constrn.; 1910-11, gen. supt. of works; 1911-12, gen. engr. on hydro-electric work; 1913-14. contracting with Dietrich, Ltd.; 1917-27, ch. engr., Electric Commission, city of Montreal.

References: J. L. Busfield, deG. Beaubien, G. R. MacLeod, R. S. Kelsch, R. M. Wilson.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

DRAKE—ROBERT LUDLOW, of Rockville Park, Ont., Born at Ottawa, Sept. 24th, 1893; Educ., public school, Ottawa Collegiate Inst., private studying; 1912, chainman and rodman. C.N.R., 1913. D.N.R., C.P.R., as rodman, concrete tester and instrumentman, promoted to concrete and timber inspector in March 1914; Nov. 1914, enlisted; May 1915 to May 1919, overseas; July 1919 to date, with Water Power & Reclamation Service, Dept. of Int., as follows: instrumentman, promoted to jr. engr. in 1922. engaged on drainage and irrigation field work as asst. engr. since the fall of 1922 owing to war disabilities, employed on office work.

References: J. T. Johnston, V. M. Meek, G. F. Richan, N. Marr, A. M. Beale.

LIBBY—PHILIP NASON, of Temiskaming, Que., Born at Gray, Me., July 5th, 1896; Educ., B.S., Univ. of Maine, June 1917; 1917 (summer), forester for Great Northern Paper Co., Bangor, Me.; 1917-19, in U.S. army in U.S.A., France and Belgium; 1919-21, dftsman for Riordon Co., Ltd., Mattawa, Ont.; June to Oct. 1921, rodman and dftsman on hydro survey for Donnacona Paper Co.; 1921-22, rodman, instrumentman and dftsman for Laurentian Power Co., Beaupre, Que.; Oct. to Dec. 1921, i/c hydro survey for G. R. Heckle, Montreal, Que.; April to July 1922, forester i/c survey party, Wayagamack Pulp & Paper Co., Three Rivers; 1922-24, with Mead Fibre Co. of Kingsport, Tenn., as dftsman and instrumentman on general mill constrn. and mtce., later as dftsman and field engr. acting as asst. to res. engr. on paper mill constrn., also in full charge of miscellaneous constrn. work and design of same; July to Oct. 1922, dftsman and designer for H. S. Taylor, Ltd., on design of E. B. Eddy news mill; Oct. 1922 to date, with Riordon Pulp Corp., Temiskaming, Que., as ch. dftsman and asst. to ch. engr.

References: G. L. Freeman, L. S. Dixon, J. A. Beauchemin, J. G. MacLaurin, J. A. Dickinson.

MACKENZIE—JOHN FENWICK FRASER, of Montreal, Que., Born at New Glasgow, N.S., June 24th, 1893; Educ., New Glasgow High School and N.S. Tech. School; 1911-13, dftsman with W. P. McNeil Co., Ltd., New Glasgow; 1913-14, dftsman with Maritime Bridge Co., Ltd.; 1914-20, structural dftsman and checker on bridge work, mill bldgs., etc., and head checker, squad leader and asst. ch. dftsman with same company; 1916-19, evening instructor in local tech. schools in structural dfting and design; 1920-21, with B.E.S. Co. at Sydney Mines on design and constrn. of Jubilee B. bankhead; 1921-25, with Dom. Bridge Co. as checker, head checker, asst. dept. head and asst. ch. dftsman; Nov. 1925 to date. design sketching for new Montreal-South Shore bridge with same company.

References: F. P. Shearwood, L. R. Wilson, A. Peden, A. R. Chambers, W. G. Matheson, R. B. Stewart, D. M. Chadwick, D. C. Tennant.

McCRUDDEN—HARRY ELSMERE, of Westmount, Que., Born at Buenos Aires, Dec. 1st, 1892; Educ., matric., Westmount Academy, 1910. three yrs. arts at McGill Univ.; 1911-14, topographer, dftsman, instrumentman and acting res. engr. ry. constrn., C.P.R.; 1915-17, overseas, C.F.A., lieut. 1916; 1918, actuarial clerk, Sun Life Assurance Co.; 1919, cost acct., factory supt., orthopaldic br., D.S.C.R., Montreal; constructive acct., D.S.C.R., Ottawa; 1923 to date, with Bell Telephone Co., as follows: May 1923, methods clerk; Feb. 1924, material supervisor, plant accountant's office; Feb. 1925, special accountant, ch. accountant's office, associated with engr. of inventories and appraisals: 1925 and 1926, costs and appraisals, depreciation studies, rate-case work; July 1st, 1927, appointed plant inventory and cost engr., engrg. dept., Montreal.

References: N. F. Parkinson, W. H. McGann, J. A. H. Henderson, H. W. B. Swabey, A. M. MacKenzie, J. L. Clarke.

RAMSAY—ENSLEY MOORE, of Ottawa, Ont., Born at Arnprior, Ont., Sept. 12th, 1892; Educ., public and high schools, commercial business course, constrn. and mech'l engrg. with I.C.S.; 1910-14, with Ottawa Car Mfg. Co., as: 1910-11, dftsman and detailer; 1911-13, designer; 1913-14. asst. supt. carriage dept.; 1914-16, with Energite Explosive Co., as: Nov. to Mch. 1914, ch. dftsman; 1914-16, superintendent i/c fuse plant; 1916-18, ch. dftsman, Imperial Ministry of Munitions, machine design, etc.; Apl. to Dec. 1918, designer and constrn. engr., Bate McMahon Co., Ottawa; 1918-19, designer, Foundation Co. steel plate mill, Sydney, N.S.; May to Oct. 1919, constrn. engr. and asst. supt., Atlas Constrn. Co., Montreal; 1919-20, asst. supt., Yates Constrn Co., Hamilton; Mar. to June 1920, designer, Major H. W. Wardwell, Montreal; 1920-21, designing engr., Riordon Co.; 1921 to date, sr. dftsman, Dept. of the Int., Water Power & Reclamation Service.

References: G. F. Richan, H. R. Cram, J. S. Tempest, A. C. Wright, L. J. Gleeson, L. S. Dixon, V. M. Meek.

REDING—THOMAS AUGUSTINE, of Hamilton, Ont., Born at Ancaster, Ont., Dec. 31st, 1894; Educ., high school, civil engrg. course with Am. School of Correspondence and private tuition in maths.; 1913-16, chainman and rodman with Mackay, Mackay & Webster, of Hamilton, and A. M. Jackson & Co., Brantford; 1916, instrumentman on constrn. with Toronto, Hamilton and Buffalo Ry.; 1917-18, overseas with Can. Engrs.; 1919 to date, i/c field and office work in connection with survey and engrg. work as carried on by Mackay & Mackay, civil engrs. and surveyors, Hamilton.

References: W. B. Ford, C. J. Nicholson, E. G. Mackay.

ROCHESTER—GORDON H., of Ottawa, Ont., Born at Ottawa, Jan. 4th, 1894; Educ., B.Sc., McGill Univ., 1922; 1911 (summer), rodman, C.N.R.; 1912 (summer), recorder, Geodetic Survey of Can.; 1913 (summer), roadman, constrn., I.C.R., North Sydney, C.B.; 1914 (summer), triangulation and plane table work, Int. Boundary Survey; 1915 (summer), i/c plane table party, Int. Boundary Survey; 1916, lieut., 242nd Battalion; 1917, lieut., 1st Tunnelling Co., Can. Engrs.; 1918, capt., 6th Battalion, Can. Engrs.; 1920-21, gen. mgr., Veritas Chemical Corp., Albany, N.Y.; 1922-24, supt. and secy., World Match Corp., Berthierville, Que.; 1924 to date, ch. of timber tests, Forest Products, Lab., Dept. of Int.

References: H. M. MacKay, E. Brown, N. E. D. Sheppard, E. P. Cameron, H. Chambers, C. M. McKergow, R. deL. French.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

BRAULT—PAUL GEORGE ADRIEN, of Montreal, Que., Born at Montreal, Sept. 12th, 1899; Educ., B.Sc., McGill Univ., 1921; 1919 (summer), chainman on survey, Walter J. Francis & Co.; 1920 (summer), dftsman, steel frames, Northern Electric Co.; session 1921-22, demonstrator in descriptive geometry and geodesy, McGill Univ.; June 1922 to Dec. 1923, detailer with Can. Bridge Co., Walkerville; Dec. 1923 to Oct. 1925, checker and estimator, gen'l bldg. work and elevator No. 3, Montreal, Can. Vickers, Ltd.; Oct. 1925 to date, sketcher and checker of details, Mtl.-South Shore bridge, Dom. Bridge Co.

References: H. M. MacKay, G. F. Porter, L. R. Wilson, F. P. Shearwood, A. Peden.

BUTTERWORTH—JOHN VICTOR, of Ottawa, Ont., Born at Yarmouth, N.S., May 24th, 1897; Educ., B.Sc., N.S. Tech. Col., 1923; 1920 (summer), student asst., Geological Survey of Canada; Oct. 1920 to Jan. 1921, field and office work, N.S. Highway Board; 1921 and 1922 (summers), student asst., Geological Survey of Canada; July 1st, 1923, to date, with Geological Survey of Canada as: 1923-26, junior topographical engineer; July 1st, 1926, to date, topographical engr. i/c party.

References: C. Camsell, W. H. Boyd, F. R. Faulkner, D. W. Munn, D. A. Nichols.

COCKBURN—JOHN MACMILLAN, of Gravenhurst, Ont., Born at Gravenhurst, Mch. 8th, 1900; Educ., B.Sc., Queen's Univ., 1924; May 1924 to date, with Can. Gen. Electric Co., as follows: 1924-25, test course; 1925-26, transformer design; 1926-27, commercial engineering, head office, Toronto.

References: D. M. Jemmett, L. M. Arkley, C. E. Sisson, W. M. Cruther, A. B. Gates.

DENEAU—GASTON, of Montreal, Que., Born at Montreal, June 23rd, 1899; Educ., B.Sc., McGill Univ., 1920; 1917-18 and 19 (summers), surveying at Belgo-Can. Pulp & Paper Co., Shawinigan Falls; 1920-24, dfting and designing, inc. design of paper machine room extensions and different service bldgs. for Belgo-Can. Pulp & Paper Co.; 1924 to date, with H. S. Taylor, designing of grinder rooms, wood handling systems and various service bldgs. in connection with paper mills, general layouts of pulp and paper mills both in Canada and the U.S.A.

References: H. M. MacKay, H. S. Taylor, J. Stadler, D. C. Tennant, G. Claxton, H. Johnson.

FARMER—ERIC WESTOVER, of Ste. Therese, Que., Born at Brome, Que., May 12th, 1897; Educ., B.Sc., McGill Univ., 1924; July 1924 to date, with Can. Marconi Co., as: 1924-26, test engr.; 1926 to date, elect'l engr. on short wave transmitter development.

References: C. V. Christie, C. M. McKergow, J. H. Thompson, E. Brown.

GWYTHER—VALENTINE MACKENZIE WILLIAM, of North Vancouver, B.C., Born at Bedford, England, Feb. 14th, 1900; Educ., B.A.Sc., Univ. of B.C., 1924; 1923 (summer), transitman, hydro-electric surveys; May 1924 to Jan. 1925, inspector on wharf and dam constrn., Power River Co.; Feb. 1925 to Aug. 1926, res. engr. on pipe location and constrn. for city of Vancouver; Aug to Sept. 1926, ch. of party on road location and topographical survey for golf links; 1926 to Feb. 1927, constrn. engr. and supt. for contractors on water main; at present, ch. of party on land survey work.

References: C. Brackenridge, J. P. Hodgson, E. A. Wheatley, W. G. Swan, W. Jamieson.

HARDY—ALBERT ELWIN, of Akron, Ohio, Born at Roland, Man., Oct. 17th, 1898; Educ., B.Sc., Univ. of Man., 1926; 1921, with municipality of Grey; 1924 and 1925 (summers), Western Drainage Co., Winnipeg; 1926-27, Marion Steam Shovel Co., Marion, Ohio.; July 1927 to date, engineer, Concrete Steel Co., Akron, Ohio.

References: W. G. Chace, J. W. Sanger, J. N. Finlayson, W. M. Scott, G. A. Walkem, N. M. Hall.

HIGGINS—JOSEPH ALEXANDER, of Negritos, Peru, Born at Mountain, Ont., Aug. 30th, 1899; Educ., B.Sc., Queen's Univ., 1925; 1919 and 1921 (summers), concrete inspector for Ont. Dept. of Pub. Highways; 1922 and 1925 (summers), recording, etc., on Geodetic Survey of Can.; 1925-26, i/c party laying out and arranging concessions for Int. Petroleum Co., Peru; 1926 to date, investigation of pipe line system of same company.

References: A. Macphail, O. S. Ellis, W. L. Malcolm, W. Wilgar, L. T. Rutledge, L. M. Arkley.

LEITCH—HUGH JAMES, of St. Catharines, Ont., Born at Westmount, Que., May 31st, 1900; Educ., B.Sc., McGill Univ., 1926; 1920 (summer), on valuation survey, G.T.R. arbitration; 1921 (summer), foreman on grading work, Montreal aqueduct; 1921-22, estimating and designing with Phoenix Bridge & Iron Works, Ltd., Montreal; 1923 (summer), i/c road construction, Laurentide Paper Co., Grand'Mere, Que.; 1924-25, asst. erection engr., Can. Vickers, Ltd.; 1925 (summer), concrete foreman on ry. bridge substructure for Dravo Contracting Co., Pittsburgh, Pa.; June 1926 to date, res. engr. on erection of steel lock gates, Welland Ship Canal, with Steel Gates Co., Ltd.

References: E. S. Mattice, C. K. McLeod, J. Laurin, H. M. MacKay, R. deL. French, A. W. K. Massey.

PAYNE—HAROLD, of Winnipeg, Man., Born at London, England, Apl. 27th, 1893; Educ., B.Sc., Univ. of Manitoba, 1927; Aug. 1916-July 1920, with Kipp Kelly, Ltd., timekeeping and cost accounting; 1921 (summer), roadman with W. Christie, D.L.S.; 1922 (summer), rodman, J. W. Pierce, D.L.S.; 1923, (summer), asst. leveller, H. Reid, D.L.S.; 1923-24, with C.P.R. as instrumentman, fence inspector, etc., on railway constrn.; summers 1925 and 1926, asst. observer with Geodetic Survey of Canada; March to June 1927, with Wpg. Hydro-Electric System on rate investigation; June 1927 to date, with C. D. Howe Company, Port Arthur.

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References: R. J. Askin, N. M. Hall, J. N. Finlayson, E. P. Fetherstonhaugh, D. G. Calvert.

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References: D. A. R. McCannel, R. W. Allen, H. R. MacKenzie, J. W. D. Farrel, D. W. Houston, T. McGuinnes.

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Geological Problems of the Spray Water Power Project in Alberta

An Outline of the General Plan of Development with Details of the Geological Investigation Carried on in Connection with the Proposed Works

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Consulting Geologist and Professor of Geology, University of Alberta, Edmonton, Alberta.

Paper read before the Lethbridge Branch of The Engineering Institute of Canada, December 4th, 1926

The Spray Water Power Project is an engineering scheme to develop hydro-electric power by the Calgary Power Company, a subsidiary of the Montreal Engineering Company, Limited. The site lies within the Rocky Mountain National Park, sixty-five miles west of Calgary, and the proposed development includes the construction of a dam 170 feet in height and 567 feet in length in Spray Canyon, thirty-two miles south of Banff, Alberta, which will result in the formation of a reservoir about eighteen miles in length. By the construction of a tunnel almost two miles long, from a point near the upper end of the reservoir, the water will be carried to Bow river slope, where an upper plant will be constructed with an effective head of 410 feet. The water from No. 1 plant will be ponded in the valley immediately below and carried through a pipe line to No. 2 plant, situated close to Bow river, with an effective head of 567 feet. The total effective head would be 1,260 feet. Figure No. 1 shows the proposed location of the various works in connection with No. 1 plant.

The project lies within the Rocky Mountain National Park, and partly on this account the license to carry out this development has not yet been given. Application for the license was made over six years ago by the Calgary Power Company, but as there was some difference of opinion as to the damage that would be done to the scenery by the construction of this reservoir the license was withheld. About three years ago the provincial government became interested, and the opinion was expressed that the project might be undertaken by the provincial government, but considerable time elapsed in getting data on the advisability of such an undertaking. It would appear that the federal and provincial governments have not yet been able to arrive at a satisfactory agreement, although both governments seem to have agreed that the license should be given to a private company, but the control of the project has not yet been decided upon. Conditions have arisen whereby more power must be obtained by the Calgary Power Company, and it is the opinion of competent engineers that this difficulty could be overcome by the development of the Spray project.

The exact location of the dam and tunnel were to a great extent dependent upon the geological structure. This was foreseen by the chief engineer of the Montreal Engineering Company, Limited, Mr. G. A. Gaherty, A.M.E.I.C., and a request was made to the federal government for geological assistance. When the request was forwarded to the Hon. Herbert Greenfield, then premier of Alberta, the writer was asked to give geological advice, with instructions to investigate the geological features, including both structural and stratigraphical, in the vicinity of the proposed project. On account of several years' previous geological work in the Rocky mountains, the writer had a general idea of conditions in this vicinity.

This investigation for the Calgary Power Company was commenced two years ago, and the geological problems that will be referred to in this paper are related to the proposed engineering development and are largely results of this investigation.

Physiography Related to Project

The eastern slope of the Rocky mountains consists of a number of parallel or sub-parallel ranges that are structurally monoclinal fault blocks. These ranges have been caused by overthrusting from the west, the westerly block overriding the easterly one. On account of this structure, there is a repetition of the geological formations in the dif-

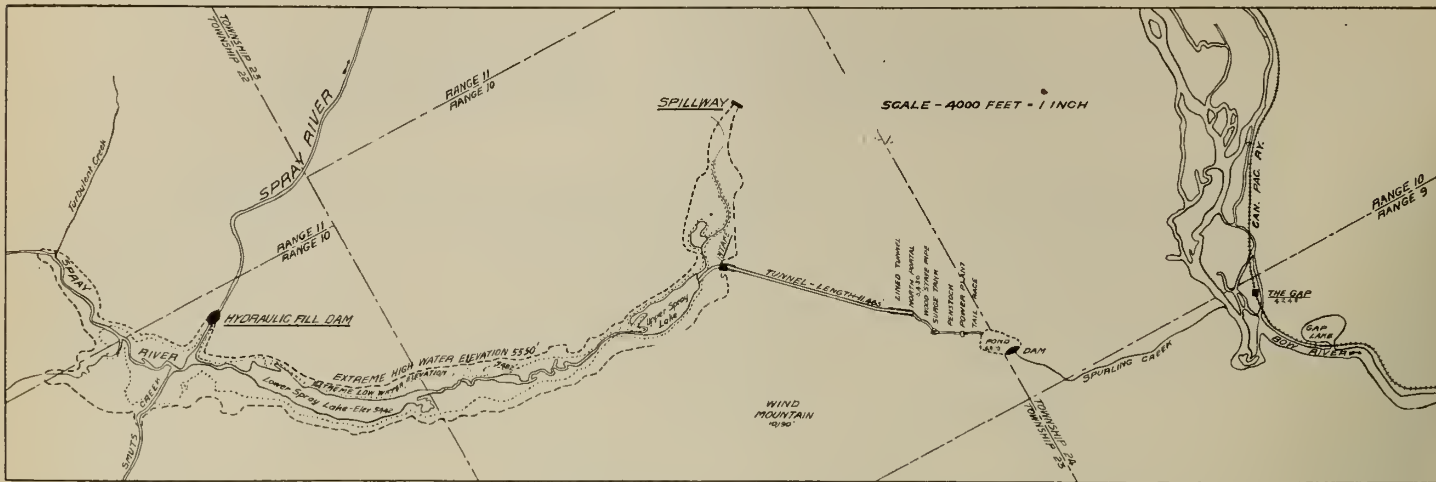


Figure No. 1.—General Plan of Spray Water Power Project.

ferent blocks. The present topography is closely related to the underlying structure. The valleys are parallel to the structure, and therefore parallel to one another, and the ridges are traversed by transverse valleys. In many cases a stream starts on one side of a range, then traverses the range and continues on the other side again parallel to the structure. This is the general structural condition in the vicinity of the Spray project. Figure No. 2 shows the location of the Spray water power site in the Rocky mountains.

The town of Banff is situated on Bow river between the Rundle-Wind mountain range and the Sulphur mountain-Goat range. Spray river enters the Bow at Banff. From its mouth upstream, the Spray follows this depression for about five miles, then cuts across between Sulphur mountain and Goat range and continues along through the depression on the west side of Goat range. At the head of Spray canyon, about twenty-two miles southwest of Banff, the Spray branches into three streams. The main Spray river turns southwest and heads in the mountains along the continental divide, one branch draining the Mt. Assiniboine district and the other branch extending farther to the southeast on the continental divide. A second branch of Spray river in the upper end of the canyon is Smuts creek. This creek follows the strike of Spray river canyon and heads between Kananaskis and Spray mountains. The third branch is Spray lake creek. This valley defines the north end of Goat range, to the northeast; then turns to the northwest and drains the depression between Goat range and the Three Sisters. This depression is the continuation of the one followed by the Spray at Banff. Along Spray creek there are two large lakes, known as Upper Spray lake and Lower Spray lake. The lower lake covers 301 acres and the surface level is 5,442 feet, while the upper lake covers 143 acres and the surface level is 5,477 feet above sea level.

The proposed reservoir will have a drainage area of 190 square miles. The total drainage area of the Spray river is 290 square miles, so that the drainage area contiguous to the reservoir will be approximately 60 per cent of the total.

General Geology

The Bow valley is underlain by rocks of Mesozoic age and include in order of age the Jurassic, Triassic and Kootenay. The Kootenay rocks underlie the southern slope of Bow valley from 4,300 feet to approximately 4,600 feet, and terminate in an overthrust fault where the older Palæozoic rocks have been thrust over the younger Kootenay formation. This break occurs in the tunnel near the north portal. West of this fault, which has been designated as the *first fault,* Devonian and Carboniferous rocks make up the entire range that is known as the Three Sisters-Wind mountain range. The Devonian rocks consist of formations known as *Intermediate limestone* and *Lower Banff limestone,* approximately 3,000 feet thick. These are both massive-bedded limestones, and about three-fourths of the entire length of the tunnel will be through these formations. The Carboniferous rocks consist of a shale series known as the *Lower Banff shale,* 1,200 feet thick, and another massive limestone, the *Upper Banff limestone* or *Rundle limestone* formation with a thickness of about 2,400 feet. These formations occur on both sides of the Upper Spray lake. Above the Upper Banff limestone, also of Carboniferous age, is the Rocky Mountain quartzite. This formation consists almost entirely of massive quartzite and dolomite interbedded with some shale. The thickness of this formation in this part of the Rocky mountains is about 200 feet. The younger rocks belong to the Mesozoic era and consist of Triassic and Jurassic strata. The Triassic rocks are known as *Upper Banff shale* or *Spray River formation.* Only a small part of the formation is shale. This formation is at least 3,000 feet thick. It is made up of calcareous shales, shaly limestone, massive limestone and dolomite interbedded. This is the youngest formation that adjoins the proposed reservoir.

The *second fault,* also parallel to the structure, crosses the valley at the upper end of Lower Spray lake where the Devonian rocks on the west are faulted over the Triassic rocks on the east.

Between the upper end of Lower Spray lake and the canyon there is a second repetition of the formations consisting of Devonian, Carboniferous and Triassic rocks. This block forms Goat range and the Sulphur mountain range to the northwest.

The *third fault* passes through the west side of the Spray canyon where the older Rocky Mountain quartzite formation of upper Carboniferous age on the west is faulted over the younger Triassic rocks on the east. The details of this fault will be given in the discussion on the proposed site for the reservoir dam.

Geology at the Reservoir Dam

An examination of the surface geology proved that there was a fault passing through the canyon where the dam would be located. In order to get the details of the geological structure in the canyon, it was evident that diamond drilling should be carried out to determine any detrimental features. Fifteen holes were drilled in the canyon with an aggregate depth of 1,881 feet. The position of these holes and the strata encountered are shown in figure No. 3. The rock cores from the diamond drill holes show that there are no dangerous structural or stratigraphic features associated with the proposed dam.

The strata on both sides of the canyon are dipping steeply to the west at angles from 65 to 85 degrees, with the steeper dips occurring on the east side. The rocks on the west are older than those on the east, and this relation of structure is explained by a fault which occurs on the west side of the floor of the canyon. The dip of this fault plane, like all other major faults in the east slope of the Rocky mountains, is to the west. There are certain members in the Spray River formation on the east side of the canyon that are porous, but these porous layers are separated by impervious strata. The cavities in the porous rock are not continuous, and there is no danger of seepage through these beds. The porous rock, almost a tufa in places, increases in thickness down the canyon but pinches out towards the top of the canyon. It was originally proposed to locate the dam farther downstream, but a preliminary geological examination resulted in the location being changed to 2,500 feet upstream, where the rock on the east was less porous.

The fault which passes through the floor of the canyon is sufficiently sealed to prevent leakage along this break. The rock in the floor of the canyon immediately below the gravel is shaly and very soft at the surface, and this soft surface will have to be removed before the dam is constructed.

The type of dam proposed is the hydraulic fill, and this necessitated an investigation of the available fill material. Thirty test holes were dug by hand on the two sides of the canyon and approximately three million cubic yards of unconsolidated material have been outlined available to the dam location. The amount of fill material required for the proposed dam is about 810,000 cubic yards. It is proposed to use a slope of 3 to 1 for the upstream and a 25 to 1 for the downstream face of the dam, with a crest width of thirty feet. The unconsolidated material for the fill consists of glacial drift of local origin in which there are few boulders and the percentage of pebbles is small. It is

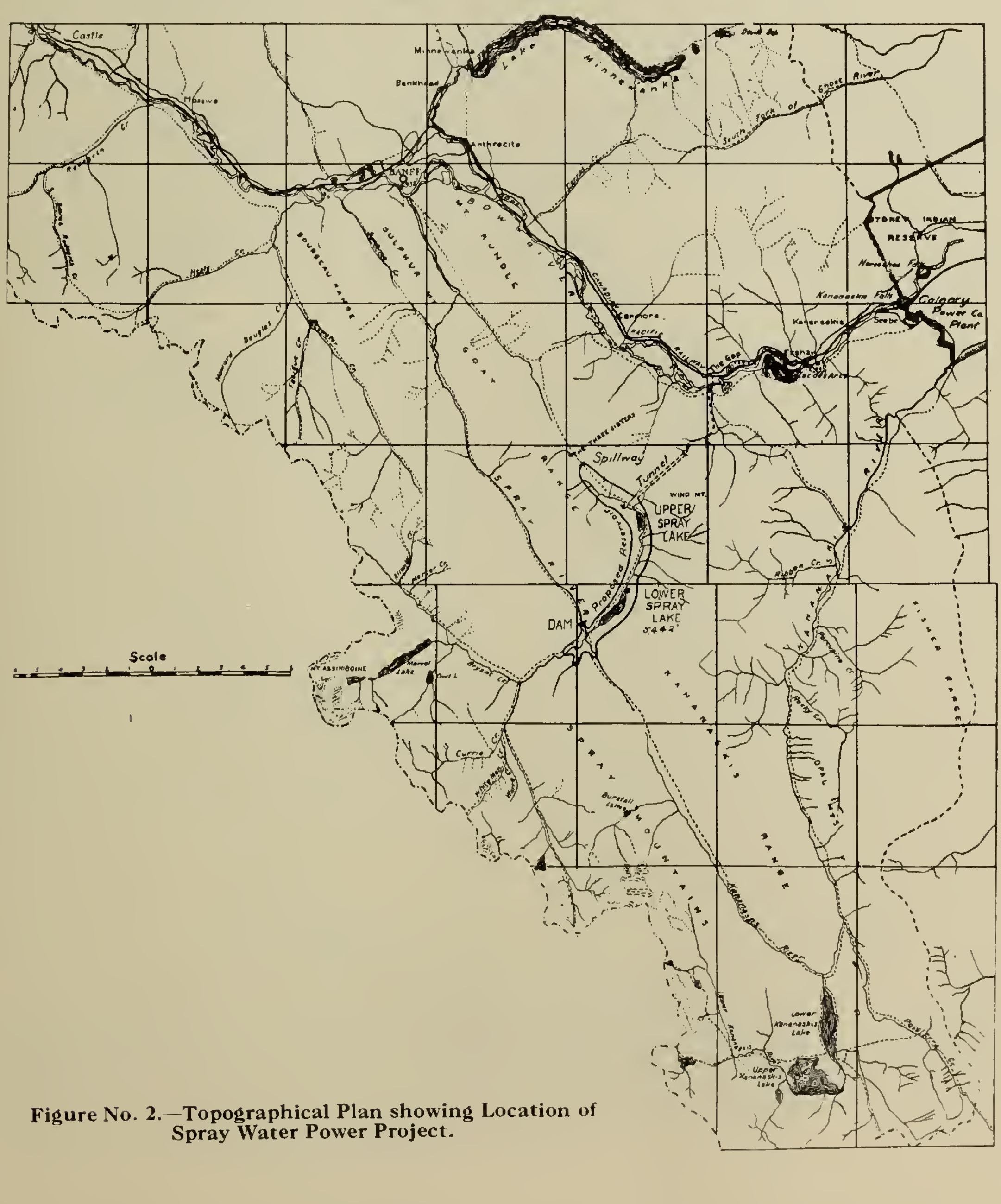


Figure No. 2.—Topographical Plan showing Location of Spray Water Power Project.

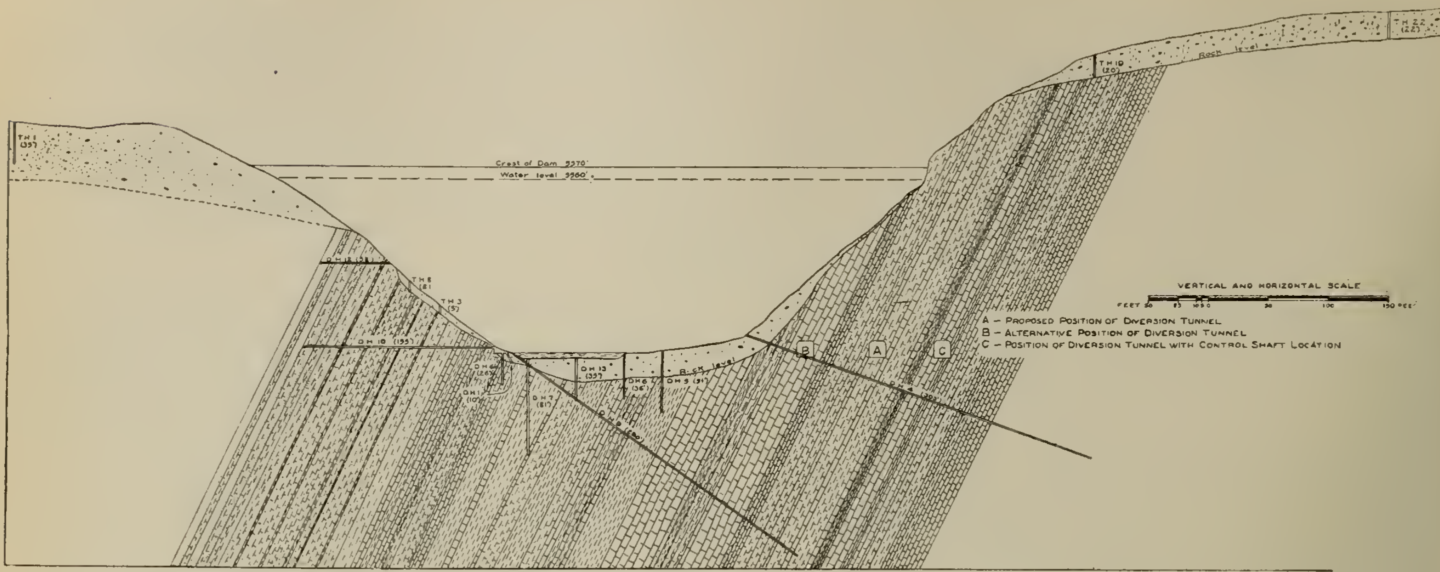


Figure No. 3.—Cross-section along Centre Line of Dam showing Location of Drill Holes and Strata Encountered.

highly calcareous, and contains very little real clay. This material has the peculiarity of being very hard, almost rock-like, when dry. In the test pits it was not possible to pick the material and it had to be drilled and blasted. Samples were taken every five feet and a mechanical analysis made of each sample. The average sample of the material is represented by the following analysis:—

Passed ⅜ inch and retained on No. 12	40 per cent
Passed No. 12 and retained on No. 20	10 " "
Passed No. 20 and retained on No. 60	20 " "
Passed No. 60 and retained on No. 100	12 " "
Passed No. 100	18 " "

A detailed analysis of the material that passed No. 12 screen shows that approximately 50 per cent is clay with a fineness less than 0.005 mm. This indicates that there will be a considerable loss in the overflow from the settling pond in the fill, so that considerably more material will have to be moved than will be required for the fill.

The rock surface on the east side of the canyon is at 5,630 feet and on the west side about 5,520 feet. The high water level of the dam is 5,560 feet and the crest of the dam 5,570 feet, so that the upper forty feet of the dam on the west side will be in this rock-like unconsolidated material. All loose material will be removed along the centre line of the dam. A sealing wall will undoubtedly have to be placed across the bottom of the canyon, but the depth of the core wall will have to be determined during construction.

The unwatering tunnel for the diversion of the water during construction will be on the east side of the canyon. It will be 1,100 feet long and will be located in a massive limestone strata that will insure against leakage or weakening of the dam. The control shaft will be located just above the centre line of the dam, and the tunnel will have to be lined as far as the control shaft to insure against any leakage when the water pressure is high. The diversion tunnel will be outside of the fill throughout its entire length.

Test pits have been sunk for gravel and sand necessary for all the concrete requirements in core wall, diversion tunnel and control shaft. Standard tests have been made on this material, and it is proved to be of good quality for concrete.

Geology Along Tunnel Site

The proposed tunnel extends from close to Upper Spray lake northeasterly under Wind divide and the north portal is at an elevation of 5,430 feet at the head of Spurling creek on the Bow slope. The length of the tunnel will be 11,463 feet, of which at least 10,500 feet and possibly 11,000 feet will be in solid formation. The intake level is 5,469 feet and the outlet is 5,430 feet. The grade will be 0.25 per cent, although about one-half the length of the tunnel will be on 0.45 per cent grade. Bedrock has not been located at the south portal, but there is reason to believe that solid rock will be reached horizontally within 500 feet. It has been possible to locate the tunnel at right angles to the strike of the rock along at least three-quarters of its length. The strike and dip of the strata and the direction of major joints had to be considered. The first 9,300 feet of the tunnel from the south portal can be driven at tangent and a small angle will place the north portal at an advantage point and where there is no danger from rock slides. Figure No. 4 is a section along the proposed tunnel.

The first fault occurs 1,000 feet from the north portal,

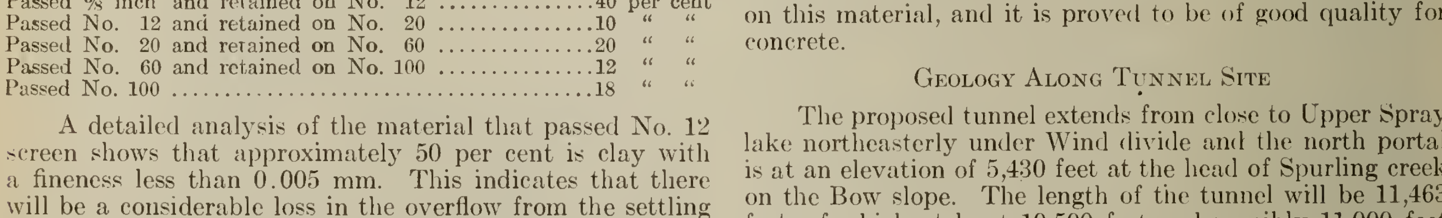


Figure No. 4.—Cross-section along Length of Tunnel.

but this structural break will not cause any engineering difficulty.

The tunnel will be 14 feet by 14 feet where unlined and 10 feet by 10 feet where lined. The characteristics of the rock formations along the proposed tunnel suggest that more than half of the tunnel will not require lining. Beginning at the south portal, the unconsolidated material might have to be heavily reinforced. The following specifications are suggested:—

500 feet at the south portal timbered and lined with concrete, through unconsolidated material.
150 feet of shaly formation lined and possibly timbered.
9,150 feet unlined.
1,550 feet at north portal concrete lined.
100 feet at the outlet portal with reinforced lining.

From the north portal the water will be carried in woodstave pipe 10 feet in diameter and on a grade of 0.16 per cent along the hillside for 2,070 feet to the surge tank, which is proposed to be 27 feet in diameter.

According to the report of the chief engineer, it is proposed to adopt a single penstock, the diameter of which would vary from 117 inches at the upper end to 99 inches at the lower end. The penstock would be supported on concrete piers about 25 feet apart, but there is still some detailed field work to be done in connection with the character of the slope where these piers would be situated; also the site of the plant at the foot of the penstock.

Detailed field work will also be required on the geology around the pond dam below No. 1 plant in Spurling creek, while there are other minor geological details on the whole engineering project that will have to be obtained before actual construction begins.

When the project is carried out and when the dam is constructed and the reservoir filled it will greatly increase the natural beauty of the surroundings. It is only necessary for those holding a different opinion on the present scenery to make a trip through that portion of the Spray valley that will form the reservoir and observe the uninteresting apearance of the valley floor and the lack of natural beauty in its present condition.

This engineering project gives an excellent example of the value of geological detail on the character and structure of the rocks at the location of the reservoir dam, spillway, tunnel, position of the portals, penstocks and other portions of the construction.

The Use of Duralumin in the Manufacture of an All-Metal Artificial Limb

With Particular Reference to its Use for this Purpose by the Canadian Government and with some Detailed Information as to the Properties of Duralumin

N. F. Parkinson, A.M.E.I.C.
Deputy Minister, Department of Soldiers' Civil Re-establishment.

Paper read before the Montreal Branch of The Engineering Institute of Canada, November 18th, 1926

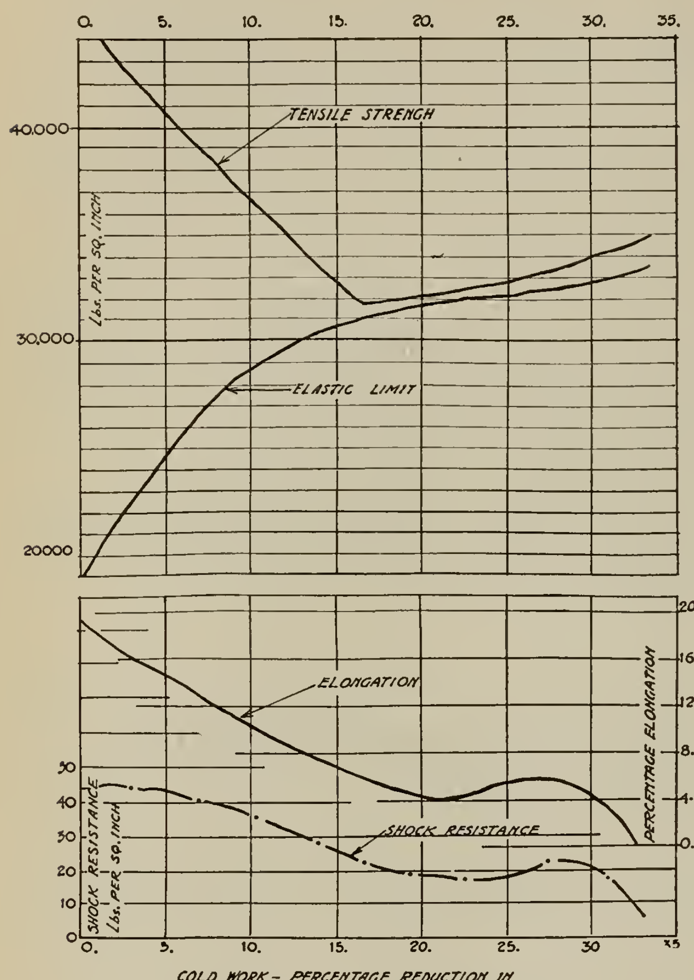
The Department of Soldiers' Civil Re-establishment is the department of the federal government charged with such re-establishment duties as regards Canadian ex-soldiers as the government may from time to time give effect to through legislation. Apart from such matters as the provision of medical treatment for those requiring it as a result of wounds, etc., and the payment of pensions on account of war disablement, the manufacture and supply of orthopædic appliances, including artificial legs, is an important feature of its work. Generally speaking, the manufacture of wooden or metal artificial legs may not be considered an accomplishment of particular engineering interest. Apart from the material used and the design of the leg produced, however, it is of interest to remember that while the amputation cases dealt with by the department suffered their amputations through war injury, the cause might just as well have been industrial accident, insofar as the effect was concerned. The development, therefore, of artificial limbs is of direct interest to all those interested in maintaining the productive ability of sufferers from industrial accidents.

In addition, as has been indicated, the subject from the point of view of the material used in the manufacture of the artificial leg may be of interest to those concerned in using such material for other purposes. While the metal used in the production of metal limbs at the present time was not developed as a result of the limb industry, its nature and properties were not generally known until after war years, it being developed as a result of the need of a strong light metal for use in aeroplane manufacture.

The information included in this paper as to the qualities of duralumin, and certain of the aluminium alloys, was not, as later indicated, obtained as a result of experimental work by the Canadian government; it is not original insofar as the author is concerned, and the only excuse for presenting it in the form of a paper is that it will probably be new to some and of interest to others.

Development of Limb Manufacture to Meet War Conditions

Artificial legs with movable joints, designed to fit comfortably stumps left after amputation and to give maximum facility of locomotion through full use of remaining leg muscles, were a natural development from the crutch and the peg. Artificial legs of various types were being made in Canada and other countries prior to the war. There were, however, no artificial limb factories in Canada having sufficient capacity to meet the abnormal needs occasioned by the war, and no standard type of leg was universally available throughout the Dominion. These conditions resulted in the decision by the Canadian government to produce a standard leg and set up its own factory for the supply of legs and other orthopædic appliances to ex-soldiers requiring same as a result of war disablement.



Longitudinal Specimens
Figure No. 1.

A government limb factory was established in July 1916, under the direction of Mr. T. J. LeCras. It was later put under the control of Major R. W. Coulthard, B.A.Sc., and has been in operation continuously since that time, being at present under the Administration Branch of the department, directed by Major E. Flexman. A standard wooden limb was developed of a quality that compares favourably with limbs turned out by any other government or manufacturer. The volume of work handled is evidenced by the following figures:—

Statement of Appliances and Supplies Manufactured and Issued by Orthopædic Branch, Department of Soldiers' Civil Re-establishment, from August 1916 to March 31st, 1926.

Legs, all types	10,556
Arms, all types	2,835
Orthopædic boots	44,962
Peg legs	1,548
Optical supplies*	24,642
Minor appliances†	124,797

The number of Canadian amputation cases, the result of war service, was as follows:—

Amputation of Leg (single)

Below and through the knee	764
Above knee	1,442
Disarticulation	20
Total	2,226

* Includes artificial eyes manufactured and issued.
† Includes splints, surgical braces, etc.

Amputation of Arm

Below and through elbow	256
Above elbow	558
Disarticulation	43
Total	857

Multiple Amputation

Two legs and two arms	1
Two legs and one arm	2
One leg and one arm	11
Two arms	3
Two legs	75
Total	92
Total amputation cases	3,175

On March 31st, 1926, the number of Canadians who were in receipt of pension for blindness or loss of one or both eyes was 1,228.

Use of Metal for Artificial Limbs

Comfort to the wearer is, of course, a great consideration in the development of an artificial leg. This combined with cost makes up the two most important factors requiring the attention of the department. Comfort involves three separate features: fit, mechanical correctness and weight.

The fit of a limb includes not only the proper formation of a *bucket* to fit the stump, but the proper alignment of the limb and foot and *balance* of a leg to the requirements of the individual wearer. Mechanical correctness includes the proper design of the limb in the first instance to provide the maximum of use and wear and the proper working of parts after manufacture. Weight depends altogether on design and material used for manufacture.

The use of wood offered itself to the development of a very satisfactory limb. For certain types of amputations, notably below knee with a fair length of stump, the results obtained were in many cases remarkable. Additional lightness was effected by strengthening a very thin willow leg through the introduction of hardwood dowels and a covering of thin rawhide on the outside of the willow.

From time to time, however, efforts have been made to find a material that would lend itself to limb manufacturing and give even greater lightness than was obtainable through the use of wood. In this connection, various substitutes were tried, including heavy rawhide, leather bound with metal strips and papier maché. It was not until some five or six years ago, however, that a metal was found that lent itself to the work, and not until about two years ago that a really satisfactorily limb, satisfactory from the point of view of design and of wear and economically possible, was produced.

The development of a metal leg is largely the result of work carried on by private firms in England. The metal that has been found satisfactory for the purpose is duralumin, an aluminium alloy produced during the war for use in the manufacture of metal aeroplanes and parts.

Properties of Duralumin

The essential properties required for a metal for use in the construction of artificial limbs are:—lightness, high tensile strength, high elastic limit and high resistance to shock. Besides this, the metal must be capable of being forged, rolled and pressed, etc., must be easily machined and must not deteriorate in use on account of corrosion or breakdown in physical structure.

Of the light alloys so far developed, duralumin appears to embody the largest number of desirable features, but in common with all the aluminium alloys, its mechanical properties depend largely upon the heat treatment employed in the process of manufacture and the final heat treatment of the finished article.

Commercial aluminium invariably contains impurities in the form of iron and silicon to an extent which varies, but is certainly not less than 1 per cent. Such impurities are, therefore, found in duralumin. In the alloy, the constituents form auxiliary compounds with aluminium and with each other, each primary substance and each auxiliary compound formed having its own melting point. The auxiliary substances may, therefore, be uniformly dispersed giving a solid solution in aluminium, or they may be segregated, depending upon the heat treatment to which the alloy is submitted.

The British Ministry of Pensions has carried out some very comprehensive experimental work under the direction of Professor Alan Pollard, their technical adviser, with a view to arriving at a proper specification for the metal to be used in the construction of artificial limbs and with a view to assisting the manufacturers of limbs under their various contracts. Complete reports in this connection have been forwarded to the Canadian government and are available for its use. While a great deal of the information contained therein is of a confidential nature, the special permission of the Ministry has been obtained to present the following data, although, as previously indicated, it is not the result of original research work in the department or by the Canadian government, the cost being beyond the overhead that could be reasonably charged to the manufacture of limbs for the comparatively small number of amputation cases in the Canadian forces to the number the British government has to provide for, it is nevertheless interesting, and the Ministry is to be congratulated on the thoroughness of its research. To say that it has been of immense value to the Department of Soldiers' Civil Re-establishment in commencing the manufacture of metal legs in Canada is, indeed, putting it mildly.

There are several aluminium alloys which have properties combined with low specific gravities, lending them to consideration for use in manufacturing metal legs. Before dealing specifically with the properties of duralumin, the alloy finally selected for this work and which apart from skleron metal, has considerable advantages over all others, some comparative information will be given. (See table No. 1.)

Table No. 1.—Analysis of the Various Alloys Dealt With.

Metal	Alum.	Ni-Al. Alloy	Cu-Al. Alloy	Alpax Metal	Duralumin	"Y" Metal	Skleron Metal
Silicon	0.27	0.30	0.36	13.05	0.42	0.17	......
Copper	trace	....	4.38	trace	4.14	3.97	3.0
Iron	0.35	0.50	0.49	0.77	0.50	0.17	trace
Nickel	....	1.39	....	....	....	2.06	1.0
Manganese	....	....	....	....	0.51	....	....
Magnesium	....	....	....	....	0.51	1.34	....
Zinc	....	trace	....	....	....	....	11 to 12
Aluminium (remainder)	99.38	97.81	94.77	86.18	93.92	92.99	84.0
Lithium	....	....	....	....	....	....	0.1 to 0.2
Tin	....	....	....	....	....	....	trace

Physical tests on cold rolled sheet specimen through a long range of temperature treatments, followed by quenching, were made, and, selecting the optimum properties obtainable at different temperatures for each metal, the figures given in table No. 2 are obtained.

Table No. 2.—Results of Physical Tests on Cold Rolled Sheet Specimens.

Alloy	Brinell Hard.	Elastic Limit lbs. per sq. in.	Ultimate Stress lbs. per sq. in.	Elongation per cent	Quench. Temp. degrees Cent.
Al-Cu	72.5	21,400	45,400	24.8	525
Alpax	55.0	9,925	33,200	17.9	545
Dural	100.0	30,800	62,500	23.0	550
"Y" Metal	102.0	27,150	56,500	13.5	550
Skleron Metal	143.0	48,200	69,000	16.5	480

The test on skleron metal was limited in extent by reason of the small amount available for experimental purposes. It is one of the newer alloys, and at the time of preparation of this information was not available in bulk. The test of which the above is the result differs further in that the test piece was a half-inch diameter bar as against standard test pieces from cold rolled plate in the case of the other metals of 20 gauge.

From the above table it will be seen that, from every point of view, duralumin is the best of the materials tested and gives materially better results than "Y" metal, the only other strong light alloy at present available. The exception is, of course, skleron metal, of which the tests were incomplete. In addition, skleron metal is slightly

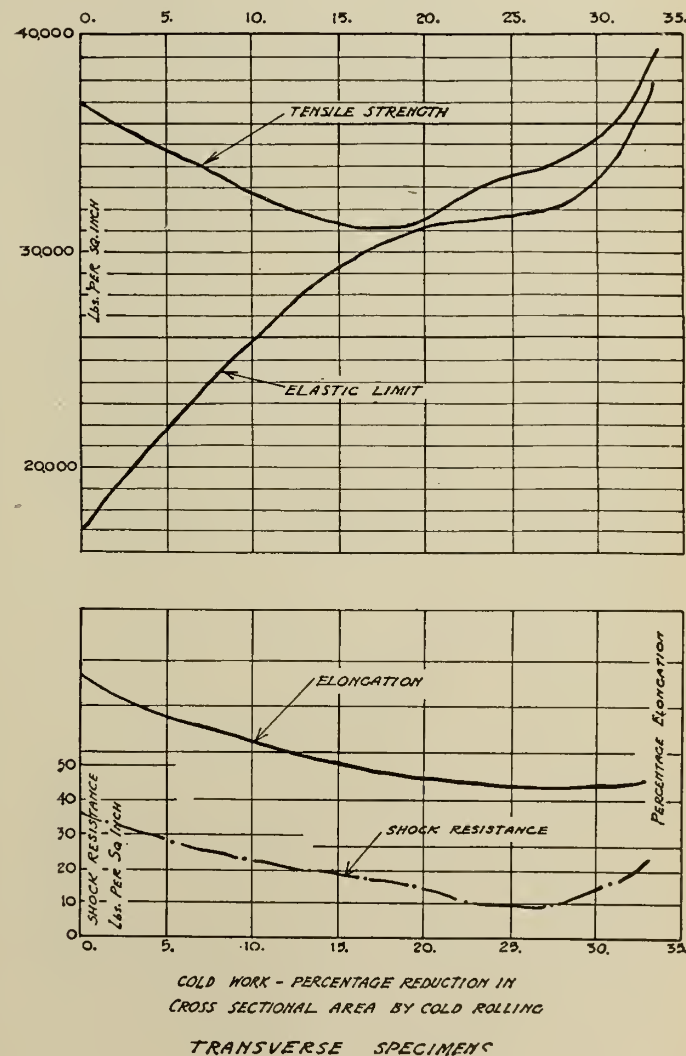


Figure No. 2.

heavier than duralumin, having a specific gravity of 2.95, as compared with 2.79.

Properties of Duralumin and Effect of Heat Treatment, Work and Corrosion

In common with all the aluminium alloys, the mechanical properties of duralumin depend largely on the heat treatment employed in the process of manufacture and the final heat treatment of the finished article. The chemical composition of the metal, as set out previously, is not always strictly adhered to. The copper content may vary from 2.5 to 5.5 per cent and the manganese content from 0.5 to 0.8 per cent. The iron and silicon proportions also vary, being present largely as impurities in the aluminium.

The alloy used in these tests had the following approximate composition:—

Copper	3.5 to	4 per cent.
Manganese	0.5 to	1 " "
Magnesium		0.5 " "

Aluminium and impurities by difference.

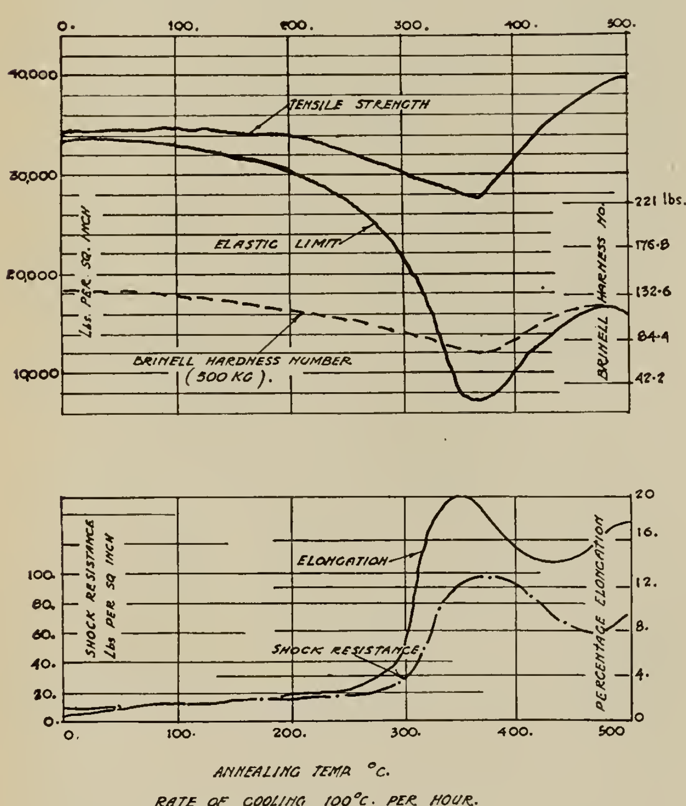


Figure No. 3.

Effect of Mechanical Work

The amount of permanent deformation produced by cold rolling was used as a measure of the amount of mechanical work done on the material. In the following, one per cent reduction in cross-sectional area produced by cold rolling is taken as the unit of work, and in a completely annealed specimen the amount of mechanical work is taken at zero. Specimens 15 mm. wide, 10 mm. thick and 100 mm. gauge length were cut from sheet duralumin which had been primarily annealed at 450° C. and cooled in the air to bring it to a standard condition as regards hardness. They were cut longitudinally with the grain of the metal, and at right angles to this with reference to the direction of rolling. The desired amount of mechanical work, as defined above, was accomplished through cold rolling.

The properties of the metal in its annealed condition are given in table No. 3.

Table No. 3.—Properties of Duralumin in Annealed Condition.

Specimen	Tensile strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Elongation per cent	Shock resistance lbs. per sq. in.
Longitudinal (with grain)....	45,500	18,500	18	42.5
Transverse (across grain)...	37,000	17,080	10	35.5

The results obtained on the work hardened material are shown graphically in figures Nos. 1 and 2, where tensile strength, etc., are plotted against mechanical work.

From the plotted results, it will be observed that throughout the range of conditions investigated the material is stronger and better able to withstand shock along the grain than across the grain. In the normal soft state, the difference in the tensile strength in the two cases is 25 per cent. The tensile strength of the material decreases rapidly with increase in the amount of *cold work* done down to a minimum, in the neighbourhood of 17 per cent reduction in cross-sectional area. There is partial recovery beyond this point. The elastic limit increases throughout the whole range of *cold work* investigated, and corresponding to this the resistance to shock diminishes. Taking specimens cut *along* the grain and after 20 per cent reduction in cross-sectional area by cold rolling, the following results are obtained:—

(a) Reduction in tensile strength by....... 29 per cent.
(b) Increase in elastic limit by............ 71 " "
(c) Reduction in elongation by........... 77 " "
(d) Reduction in shock resistance by...... 56 " "

From the above, it will be noted that when pressed, cold rolled or stamped duralumin is employed it is essential that the article should be annealed on completion if satisfactory results are to be obtained.

From the elongation curves, it will be observed that with a 33 per cent reduction in area the elongation is sensibly zero. In the production of duralumin parts from sheet having a thickness of 10 mm. or upwards, no single operation should therefore produce a greater reduction in cross-sectional area than about 30 per cent if fracture is to be avoided. Similar tests carried out on a 2-mm. sheet showed a reduction of 50 per cent in an operation was permissible. When a greater reduction than the above is required, the operation should be conducted in two or more stages with interstage annealing.

Effect of Annealing Temperature

An investigation was carried out on 10-mm. test specimens, similar to those already described cut from sheet duralumin, work hardened to the extent of 33.3 per cent. Specimens were again cut along and at right angles to the grain. Up to 300° C. annealing was done in an oil bath, from 300° C. to 400° C. in a bath of sodium nitrate and from 400° C. to 500° C. in a bath of potassium nitrate.

Two standard rates of cooling were adopted for purpose of comparison:—

(a) Cooling very slowly in the annealing bath; maximum rate of cooling 100° C. per hour.
(b) Cooling in air.

After cooling, the metal was allowed to age for eight days before testing to ensure stability.

The results obtained in tests of the longitudinal specimens are shown graphically in figures Nos. 3 and 4. The results obtained on the specimens cut across the grain are not shown, as they indicate the same general characteristics,

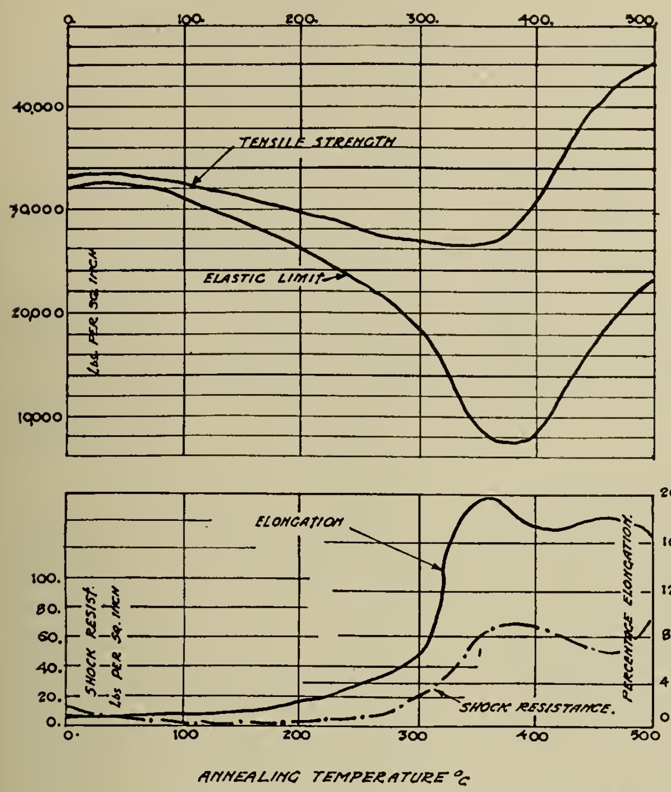


Figure No. 4.

with the differences in tensile strength, etc., previously mentioned.

From the chart, it will be observed that the two annealing temperatures, 350° C. and 475° C., are of particular interest. These are abstracted and give the results shown in table No. 4.

Table No. 4.—Results of Tests of Longitudinal Specimens at Annealing Temperatures 350°C. and 475°C.

Annealing temperature degrees Cent.	Rate of cooling	Tensile strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Elongation per cent.	Shock resistance lbs. per sq. in.
350	(*a*) 100°C. per hour	28,450	8,500	20	85.0
	(*b*) in air	28,450	10,000	20	56.9
475	(*a*) 100°C. per hour	39,800	17,000	16	56.9
	(*b*) in air	45,500	25,600	18	56.9

The lower temperature gives a soft anneal with moderate tensile strength and maximum elongation and shock resistance. This temperature would appear to be the most satisfactory at which to anneal the material between stages in the process of manufacture. The higher annealing temperature yields a tensile strength of from 40 to 60 per cent greater, depending on the rate of cooling, an increase in the elastic limit and a slight reduction in elongation and shock resistance.

Effect of Quenching

The rate of cooling after annealing at this higher temperature obviously has an important bearing on the physical properties of the metal. This point was further investigated by submitting similar samples to quenching in water at 20° C. after annealing at various temperatures. After quenching, the specimens were again allowed to stand for eight days. The results obtained are shown graphically in figure No. 5.

It will be noted that at the lower temperature, 350° C., the tensile strength does not change, remaining at about 28,450 pounds per square inch. The elastic limit is raised somewhat from 8,500 pounds per square inch for slow cooling and 10,000 pounds per square inch for air cooling to 12,600 pounds per square inch for quenching in water. The elongation is reduced 5 per cent and the resistance to shock from 85 to 42.5 pounds per square inch. At the higher temperature, however, *i.e.*, 475° C., the tensile strength is increased from 39,800 and 45,500 pounds per square inch at the two slower rates of cooling to 56,800 pounds per square inch; the elastic limit is raised from 17,200 and 25,200 pounds per square inch to 28,400 pounds per square inch; the elongation is raised 4 and 2 per cent respectively, while the resistance to shock remains practically constant at about 57 pounds per square inch.

The heat treatment which yields maximum ductility consists in annealing at 350° C. and cooling very slowly. The heat treatment which gives the maximum of tensile strength, elongation, hardness and shock resistance consists in annealing at 475° C. and quenching.

The first treatment is preferable as an interstage annealing process, while the latter should be applied to the finished article.

Re-annealing

Double annealing was investigated over a temperature range up to 500° C. on a series of specimens which had previously been annealed and quenched. Again these different rates of cooling were investigated. The details of the results obtained will not be given here, but the general conclusions were that re-annealing at 350° C. and slow cooling

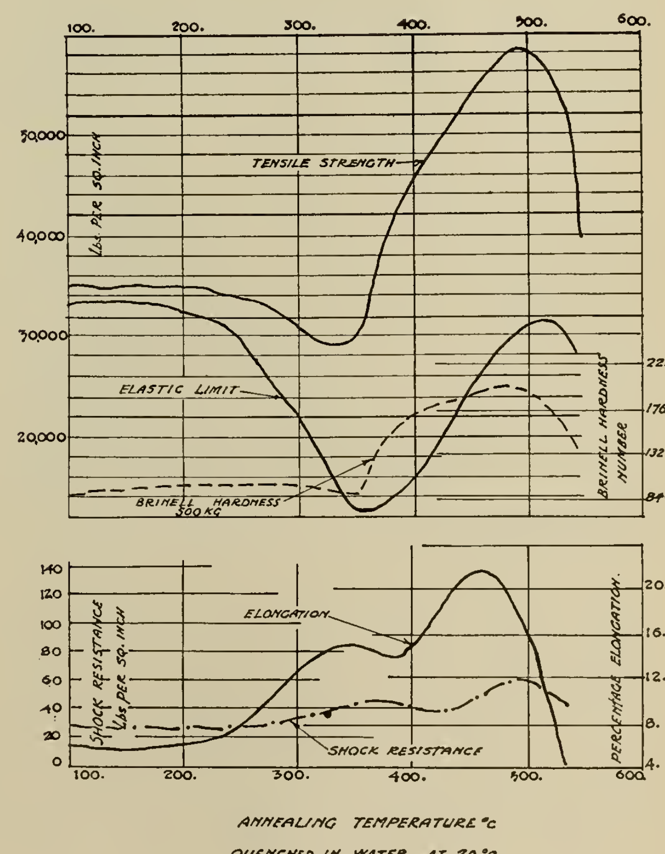


Figure No. 5.

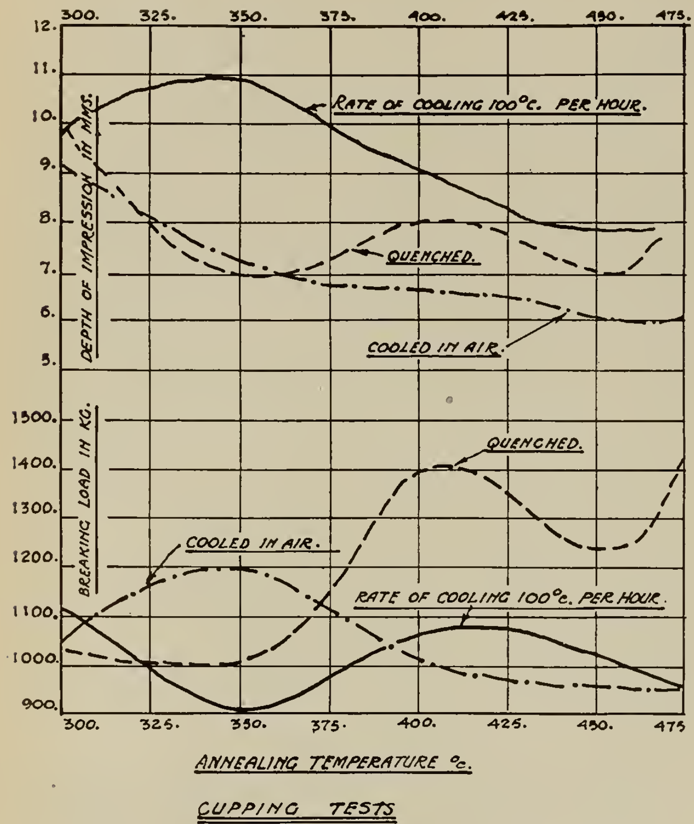


Figure No. 6.

was found to have no effect on the ductility of the metal. Re-annealing at 475° C. and quenching in water was, however, found to be advantageous. The tensile strength remained constant at about 56,800 pounds per square inch. The elastic limit was raised from 28,400 to 32,600 pounds per square inch; the elongation was increased 2 per cent and the shock resistance from 56.7 to 71 pounds per square inch.

Resistance to Shock

Certain cupping tests were carried out with a view to confirming results previously obtained. These were conducted in a Porsoz apparatus, with a 20-mm. diameter ball. The test specimens, 90-mm. diameter, were cut from a duralumin sheet 2 mm. in thickness and previously work hardened to the extent of 28.5 per cent reduction in cross-sectional area. Tests were carried out over a temperature range up to 475° C. and with the three different rates of cooling. The results are shown graphically in figure No. 6, where the maximum depth of the domes formed in the sheet and the fracture load are plotted against the temperature of anneal. The general shape of the curves shows the marked advantage of annealing at 350° C. and cooling slowly when the maximum ductility is required.

Influence of Time on Mechanical Properties

As previously set out, specimens subjected to tests were allowed to age for eight days. This procedure was adopted on account of the results of tests carried out in this connection. The investigation showed that the metal undergoes a general improvement with age. The tensile strength, elastic limit, etc., were found to increase rapidly during the first four days and at a lower rate during the succeeding four days. Beyond this period, little change was found, even after the lapse of several months. Change of material magnitude was found to occur in the first few hours, and the following table of figures, the mean result of tests on specimens quenched from 475° C., illustrates the point:—

Table No. 5.—Mean Results of Tests of Specimens Quenched from 475°C.

Time after quenching	Tensile strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Elongation per cent.	Shock resistance lbs. per sq. in.	Brinell hardness No. 500 kg.
0 hrs.	40,300	14,500	19.5	75.6	60
2 "	42,500	16,800	18.7	68.5	62
4 "	45,000	19,000	19.0	64.2	65
6 "	47,700	22,400	19.5	61.3	70
8 "	49,300	24,600	20.0	58.5	74
10 "	50,000	25,800	19.7	57.0	77
4 days	54,000	31,200	22.0	48.5	..
8 "	54,000	31,200	20.0	51.3	.

Notes on Annealing

Test results are not available to indicate the time required for completely annealing duralumin sheet. In the case of duralumin up to 10 mm. thick, the time required for complete anneal at any temperature between 350° C. and 500° C. is from 3 to 4 minutes. This should be equally applicable to duralumin sheet.

Annealing may be carried out in a salt bath or preferably in a gas or electrically heated muffle. Salt baths are objectionable in that particles of salt are retained in the pores of the metal, and this may give rise to corrosion, as discussed later. On the other hand, a gas heated muffle is liable to cause uneven heating of parts, so that an electric oven with proper temperature control is the best appliance for general purposes.

The permissible variation from the optimum annealing temperatures is relatively small, and large temperature variation must be avoided. Under the circumstances, should duralumin parts be exposed to direct contact with an open flame, this may cause local overheating to such an extent as to completely destroy the metal.

Corrosion

One other important feature that must be considered in the use of all metals of aluminium content or type is the question of corrosion. Under normal conditions, when duralumin is exposed to the air, a thin layer of aluminium hydroxide forms on the surface. This is of a vitreous nature, is transparent and can only be detected by delicate means, such as its absorption of dyes, etc. With alternate wetting and drying, this skin cracks and exposes a fresh metal surface to further chemical action. Alumina is thrown up around these cracks producing the white spotted appearance associated with duralumin which has been exposed to the atmosphere for a prolonged period. This local action spreads between the vitreous hydroxide film and the metal, and the former finally flakes off, leaving the metal unprotected. When duralumin has been wetted by sea water or by perspiration, or when the metal has been heat treated in a salt bath, the pores of the metal become filled up with the salt, thus accentuating the corrosive action.

Corrosion is generally accepted as being the result of electrochemical action. It may be taken as a fact of experience that metals in general do not oxidize or corrode in contact with perfectly dry air or in pure water from which air is completely excluded.

Duralumin has in its make-up magnesium, a metal of high electro-positive value, and copper, a metal of low electro-positive value. Any metal of this nature will corrode by galvanic action if immersed in an electrolyte. The electrolyte which induces corrosion in artificial limbs is, of course, perspiration.

Human perspiration has the following approximate composition:—

Water	99.0 per cent.
Sodium chloride	0.3 to 0.5 " "
Protein substances	Trace
Urea	"
Sebum,—comprising fatty acids, acetic acids, formic, higher alcohols, etc.	

Effect of Heat Treatment on Rate of Corrosion

Corrosion in duralumin may be considerably retarded through proper heat treatment after completion of work. Certain tests have been conducted by Professor Polard in this connection, and it may be interesting to look into the results briefly.

The surface of a non-homogeneous alloy may be regarded as consisting of a large number of areas in which the constituents or auxiliary alloys of these are segregated. Corrosion then proceeds as a result of galvanic action between areas of different electrical potential. This type of corrosion is characterized by the formation of deep pits at the centres of activity and the piling up around these of the products of corrosion. Corrosion resulting from segregation obviously becomes more serious as the number of constituents in the alloy increases, and alloys of the duralumin series are particularly liable to corrode from this cause.

Local strain may also effect an increase in the rate of corrosion by setting up differences of potential between neighbouring portions of the metal. This is particularly the case with thin sheet. The evidence available appears to indicate that a moderate amount of cold rolling has a beneficial effect, due presumably to consolidation of the metal. It is noteworthy, however, that corrosion almost invariably starts when the metal has been sheared, punched or drilled.

The extent of corrosion in metals of this type may be very serious, as illustrated by the following experiments:—Test specimens were prepared after annealing at 350° C. and cooling slowly; chemically cleaned by immersion in 10 per cent solution of sodium hydroxide, followed by immersion in a 10 per cent solution of nitric acid and thorough washing. Sodium chloride solutions of varying concentrations were prepared and the specimens suspended in large bottles about half filled with the solution, the samples being thoroughly wetted periodically throughout the test. With the weaker solutions, up to 5 per cent, the test was concluded in 13 days, while with the stronger solutions it was continued for 26 days, the rate of corrosion being so much slower.

On the completion of the tests, the specimens were washed, dried quickly and the adherent products of corrosion carefully brushed off. The results obtained are shown in figure No. 7. The maximum effect obtained was with 0.4 per cent solution, when the loss in weight was 223 grams per square metre of exposed surface in 100 days.

The weight of a 19-gauge sheet giving one square metre of total surface is approximately 1,390 grams. If failure is assumed to occur when weight is reduced 50 per cent, the usual life of the metal under the worst conditions is approximately 310 days. This takes no account of contributory factors which may considerably accelerate the rate of corrosion. In this connection also, it is worthy of notice that the normal concentration of sodium chloride in human perspiration is from 3 to 4 grams per litre, or corresponds to the maximum rate of corrosion as above indicated.

Protection of artificial legs against this rapid rate of corrosion is obtained in two ways: (1) through heat treatment, and, (2), through use of a protective enamel.

Effect of Heat Treatment on Rate of Corrosion

Tests similar to the above were carried out on samples that had previously been subjected to heat treatment. The results of these tests are set out below:—

Table No. 6.—Loss of Weight of Specimens Previously Subjected to Heat Treatment, in Grams Per Square Metre Total Surface in 100 Days.

Gauge Thickness	Heat Treatment (A) Cold-rolled from 19 S.W.G.	(B) Annealed at 350° C. and cooled slowly	(C) Annealed at 475° C. and quenched	(D) Annealed at 525° C. and quenched
19 S.W.G.	13.36 (*normalized*)	262.8	29.88	39.12
20 S.W.G.	16.68	176.4	21.08	18.04
21 S.W.G.	21.08	210.8	18.08	12.04
		Loss of weight in grams per square metre of total surface per 100 days.		

The above results indicate clearly the remarkably low resistance to corrosion of the soft annealed metal; comparison indicates that this treatment results in a rate between 9 and 10 times greater than obtained when annealing temperature of 475° C. is used.

It would appear that hardening by cold rolling causes a slight increase in the rate of corrosion, but cold rolling followed by annealing and quenching is beneficial.

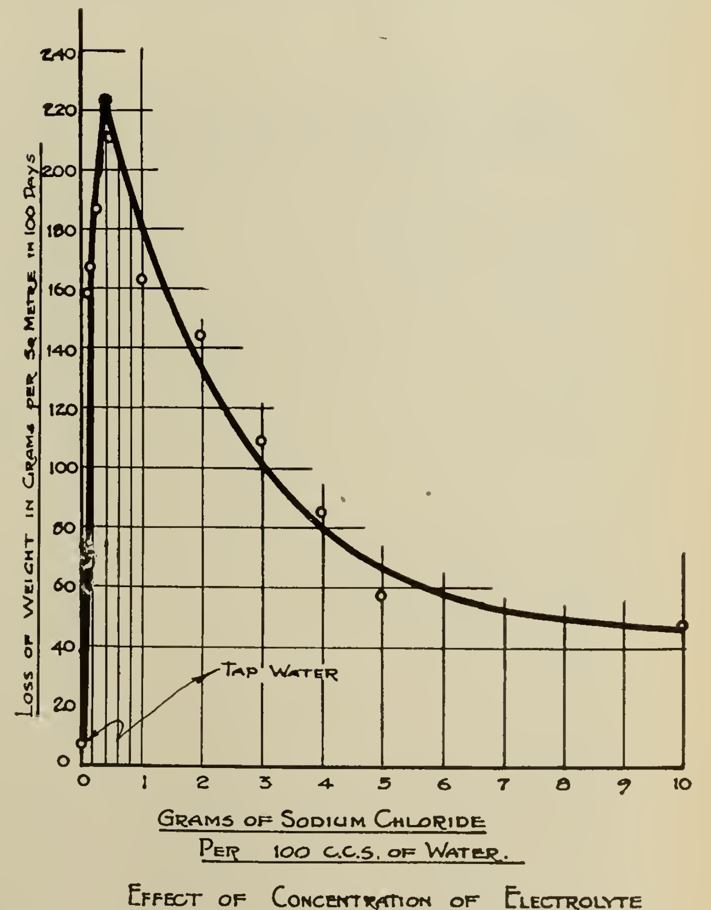


Figure No. 7.

Protection Through Application of Enamel

Apart from heat treatment as a preventative of corrosion, certain protective coatings offer a measure of additional protection. Such a coating must not only prevent contact between the metal and an electrolyte, but must of itself be non-corrosive. A paint or enamel for this work must be chemically inactive, easily applied, dry rapidly and show no liability to form pin holes and have the minimum of shrinkage on setting to avoid fracture or peeling.

Collodion lacquers and enamels were found after many tests to give the best results and be the most satisfactory for use in limb work and as deterrents to corrosion. They dry rapidly and form a hard durable coating.

The limbs as at present manufactured in Canada are turned out with a bright polished surface on the outside, the inside of the bucket being enameled by use of an air gun.

Features of Design

The present leg for above knee amputations may for descriptive purposes be divided into five parts, *i.e.*, (1) bucket; (2) knee piece and knee joint; (3) shin piece and ankle joint; (4) foot; (5) finish.

The bucket is made up in standard sizes adjustable as to girth and length and adjusted further to individual requirements by " beating out " to fit uneven stumps, etc. It is designed to carry the weight partly through pressure on the side of the stump and partly through a *seat* built on to fit the individual. The knee piece is riveted to the bucket and holds the knee joint, which is free moving and is fitted with a special lever over which thongs attached to the shoulder braces are run to provide a control of the knee sufficient to guard against falls through non-complete leg movement over uneven ground. The knee piece is further fitted with back and front stops to limit the movement of the lower leg.

The shin piece is made up of two pressed sides counter sunk, riveted back and front and made to follow the lines of the normal leg insofar as possible. The ankle joint has limited movement in the vertical plane to approximate the movement of the human foot.

The foot is wooden, with a break at the place where the toes should commence. This break is hinged on the bottom with leather, and soft rubber cylinders are inserted above to give limited toe motion. The result of the above joints and controls is to make possible for the wearer a walking motion almost the same as with a normal leg and at the same time to provide comfort to the wearer through the avoidance of unnecessary or unusual motion in walking.

The finish of the leg, bright metal with protetctive shields on parts where clothes would be damaged through rubbing, is the best that can be designed for wearing and appearance. An all-over enamel finish is probably pleasing at first, but chipping through wear and abrasion causes eventually an unsightly appearance.

Advantage of Metal Over Wood

Naturally, the most noticeable advantage of the metal limbs over the wooden is in the question of weight. Some average limbs were selected, the wood and the metal in each case being for about the same size man and about the same length of stump, and the weight of each obtained for comparative purposes. The following table indicates the variations:—

Type of amputation	Weight of wooden leg	Weight of metal leg
Symes (through ankle)..........	3 lb. 4½ oz.	1 lb. 15 oz.
Below knee	4 " 9 "	4 " 8½ "
Above knee	5 " 10 "	4 " 5 "
Disarticulation of hip	10 "	5 " 8 "

A further advantage, however, is obtained in the ready application of metal to the fitting of unusual cases, involving stumps that are fixed at unusual angles through ankylosed joints. The metal can be readily adapted to these unusual fittings without adding greatly to the weight of the finished leg. This is not the case where wooden buckets are required.

It is expected that the ultimate life of a metal limb will be more than double that of the wooden one. This is important, not only from the economical point of view, but should provide an added degree of comfort for the amputation case who has a comfortable fitting bucket and leg and does not want to change. The average life of the present wooden leg issued by the Department is about four years. It is hoped, and experience so far in England leads one to believe, that the metal limbs should last at least ten years.

Manufacture of Metal Leg in Canada by Department of Soldiers' Civil Re-establishment

In building up a factory and fitting service for the supply of wooden limbs in Canada, the department has been most anxious to employ ex-soldiers, and particularly disabled ex-soldiers. When the question of use of a metal leg came up, therefore, ways and means of continuing the staff of this factory in employment were looked for rather than to purchase the legs made up complete outside of Canada. The two firms in England who had been successful in producing a leg satisfactory to the Ministry of Pensions were approached and the final arrangements made with the J. E. Hanger Company, Limited, of London, England, were very satisfactory in this regard. As a result, the general manager of that company has spent some four months in Canada and has loaned to the department for an unlimited period of time a fully qualified mechanic trained in the metal limb business, all for the purpose of instructing the present orthopædic staff in the manufacture of the metal legs. These are now being turned out from the department's limb factory in Toronto, and it is hoped that soon they may be supplied from the various fitting depots throughout Canada.

The Bryson Hydro-Electric Power Development

Some Features of the Hydro-Electric Power Development Constructed on the Calumet Channel of the Ottawa River near Bryson, Que., by the Ottawa River Power Company

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General Manager, Power Corporation of Canada, Limited.

Paper read before the Montreal Branch of The Engineering Institute of Canada, November 25th, 1926

The Ottawa river, at a point near the village of La Passe, is divided into two channels by the island of Grand Calumet, the westerly course being known under the name of the Rocher Fendue channel and the easterly course under the name of the Calumet channel, and at a point some twenty-two miles downstream from the point of division near the village of Bryson there occurred, over a distance of a little over one-half mile, through a rocky gorge interspaced with a number of small islands, a series of rapids having an available head of 60 feet.

The Calumet channel of the Ottawa river had previously been maintained by the Dominion government for the purpose of floating the quantities of squared timber which in days gone by had made the Ottawa river more or less world famous, and at the head of these rapids a timber crib stone-filled dam had been constructed by the federal government for the purpose of controlling the water required for the operation of the log slides, which had also been built by them in order to handle this particular type of timber in such manner that it would not be damaged through contact with the various islands and rocks in the channel. It is interesting to note that this work had been carried out by the government some one hundred and fifty years ago, and that various portions of the work were found to be in a remarkably sound condition, and, in particular, of course, all sections which were permanently under water.

The watershed tributary to the Ottawa river at Calumet falls is 27,914 square miles in extent, almost completely wooded and with very little possibility of it being cut off or devastated to such an extent as to interfere seriously with the natural run-off. Careful water gaugings of the Ottawa river had been taken and accurate records preserved by the Department of Public Works for the past twenty years or more, and, based upon these, the minimum flow of the river at the point of division of the channels was accepted as being 11,700 cubic feet per second.

The division of water at this point during the low stages of the river, upon investigations also carried out for a number of years, was found to be almost exactly equal, although during the higher stages of the river the discharge down the

Figure No. 1.—General View showing Site of Bryson Power Development.

westerly or Rocher Fendue channel was very much in excess of that through the Calumet channel, which feature was fortunately to the advantage of the site under development.

A certain amount of conservation on the Ottawa river has already been undertaken also by the Department of Public Works at the outlets of the Quinze and Temiskaming lakes, although at the present time indifferently and ineffectively operated. These storage basins present much greater possibilities of improving the regulation of the Ottawa river, and a minimum flow of not less than 22,000 second-feet might be anticipated.

Based upon these figures, the available and ultimate power capable of being developed at this site would be 75,000 h.p. delivered on the bus bars at 100 per cent efficiency, and the plans, prepared after very careful consideration, provided for three 25,000-h.p. units, or a total of 75,000 h.p. Although at present one of these is regarded as a standby unit, it is conceded that there is ample possibility for each to become fully operative. Therefore, a fourth similar unit could be added if subsequently found to be desirable or justified by changed conditions.

The general scheme of development, as shown in figure No. 2, comprises a dam across the foot of the rapids, with the power house at the mouth of a small gulley, which constitutes the forebay, and a canal cut through the solid rock of the river bank to convey the water impounded by the main dam to this forebay.

A contract for the construction work having been entered into, the work actually commenced on October 24th, 1923. A siding of over 1,000 feet in length had already been constructed by the Canadian Pacific Railway from the freight yards at Campbell's Bay to a wharf or dock constructed on the river, at which point storage warehouses of sufficient capacity had been erected, with the necessary derricks for handling all material to be delivered at this point for trans-shipment to the site of the development by boat and scow, and at another point on the river five miles below, known as Pigeon Landing, a similar dock had been constructed, also equipped with derricks and storehouses.

The first work to be considered was naturally the establishment of camps to take care of the employees, and with this in view accommodation was rushed to completion for approximately six hundred men, together with storehouses, office and other buildings as were necessary, and at the same time a mile and a half of standard gauge railway was constructed from the boat landing to the site of the dam and power house for the purpose of conveying all material landed by the scows.

The transmission line for the purpose of connecting this plant with the other plant of the company in the city of Ottawa had already been constructed, and power was switched on to this line on December 21st, 1923, for the purpose of lighting the camps and operating such construction plant as was then installed. Delivery of all construction machinery was arranged for prior to the freeze-up of the river, and the work of erection commenced without delay.

The first actual development work to be undertaken consisted of the construction of the main cofferdam at the head of the rapids and immediately in front of the old government dam. It was at first considered possible that this old dam might be utilized, with relatively slight additions, and comprise the main body of the cofferdam, but upon investigation it was found that this was not sufficiently watertight and it would be more economical to use this old structure as reinforcement for a new timber crib dam to be built immediately in front and waterproofed in the usual manner with sheeting.

The greatest depth encountered in this work at this point was not in excess of 20 feet, and no unusual difficulty was experienced in satisfactorily shutting off the flow of this channel. Under ordinary conditions, the level of the yearly flood waters at the site of this cofferdam almost immediately opposite the village of Bryson, controlled by the normal division of the water at the upstream end of the island, was found to be at elevation 347.5 and during the period of maximum flood at elevation 351.7. These elevations would also obviously limit the maximum elevation of the pond level of the proposed works, which was accepted for normal operation as elevation 350, to which level the Dominion

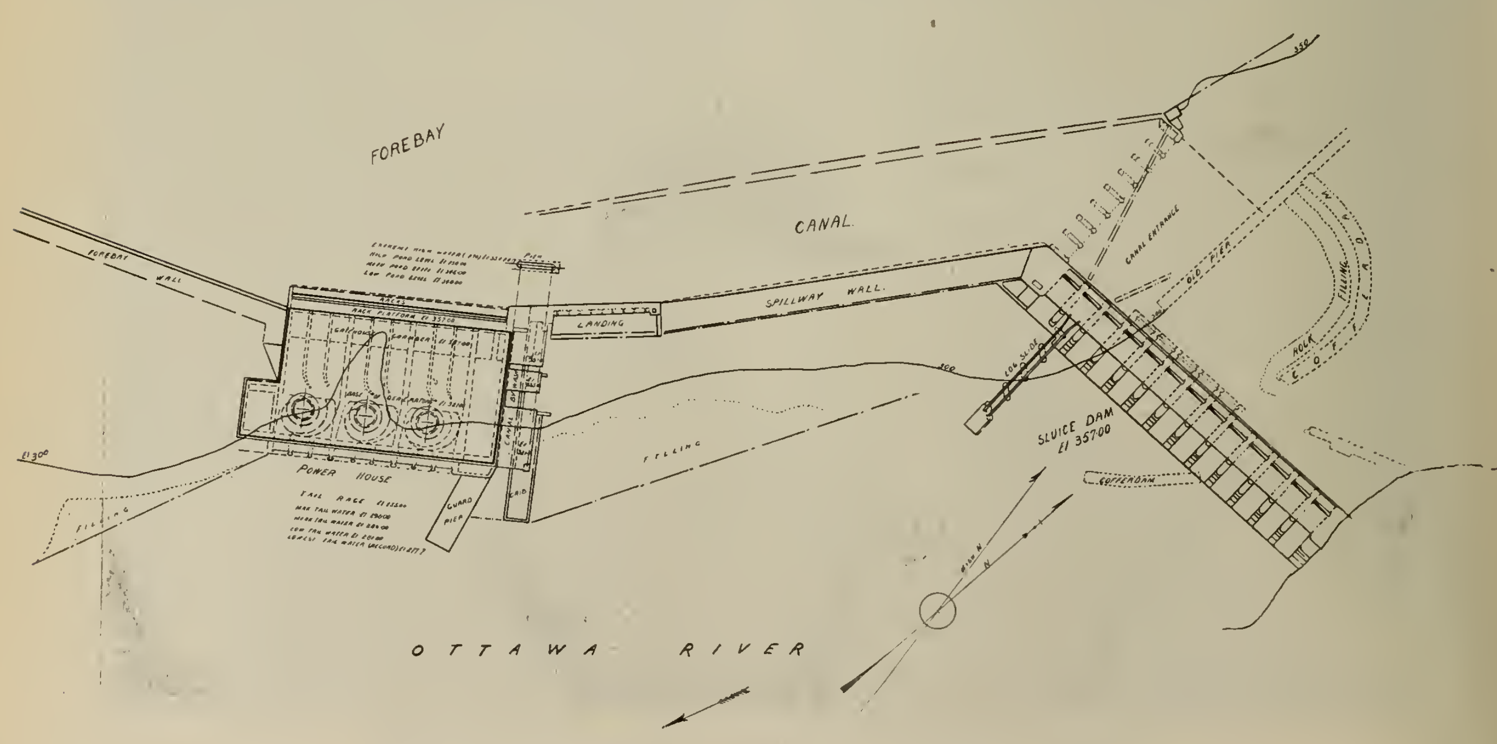

Figure No. 2.—General Layout of Power Plant and Hydraulic Works.

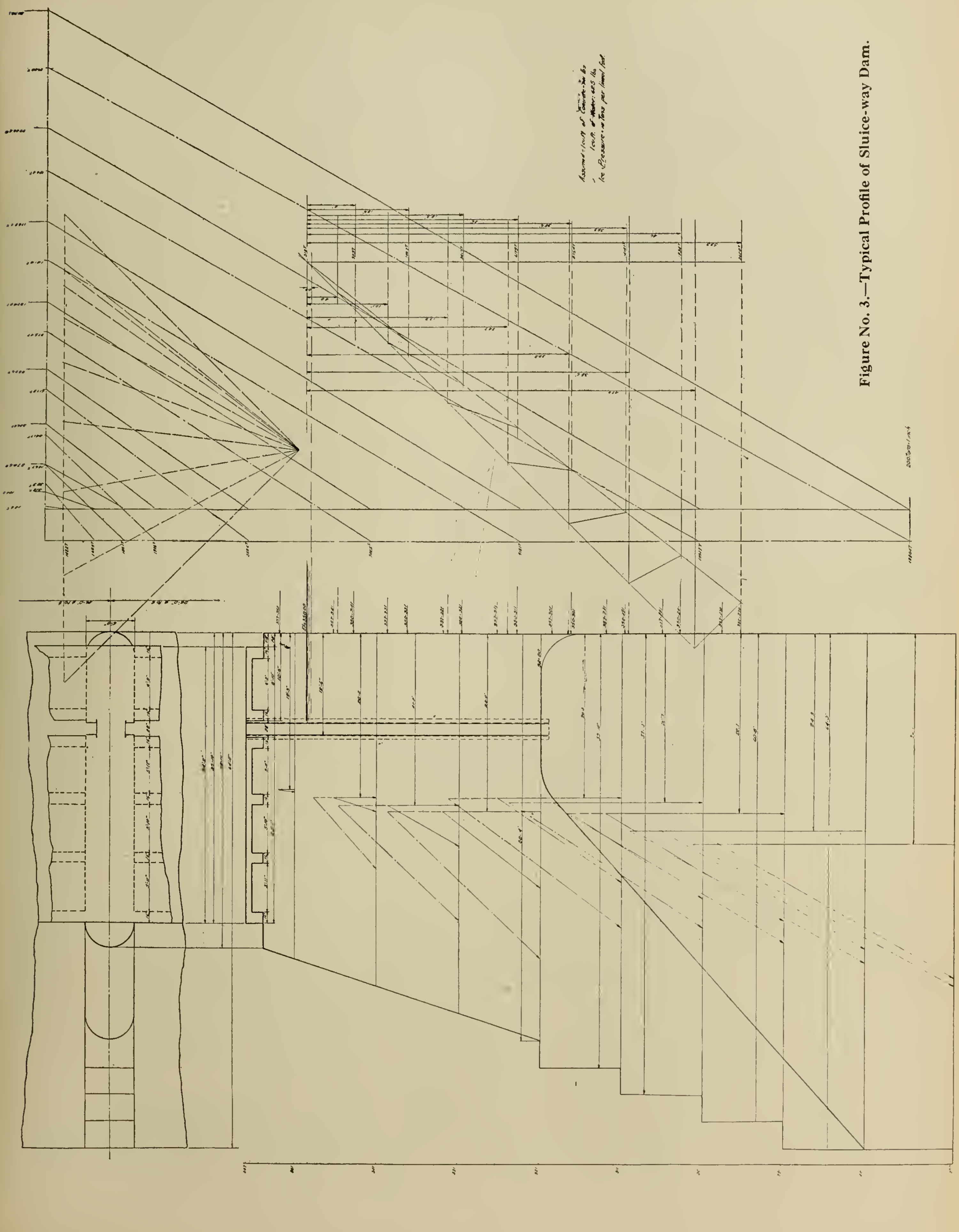

Figure No. 3.—Typical Profile of Sluice-way Dam.

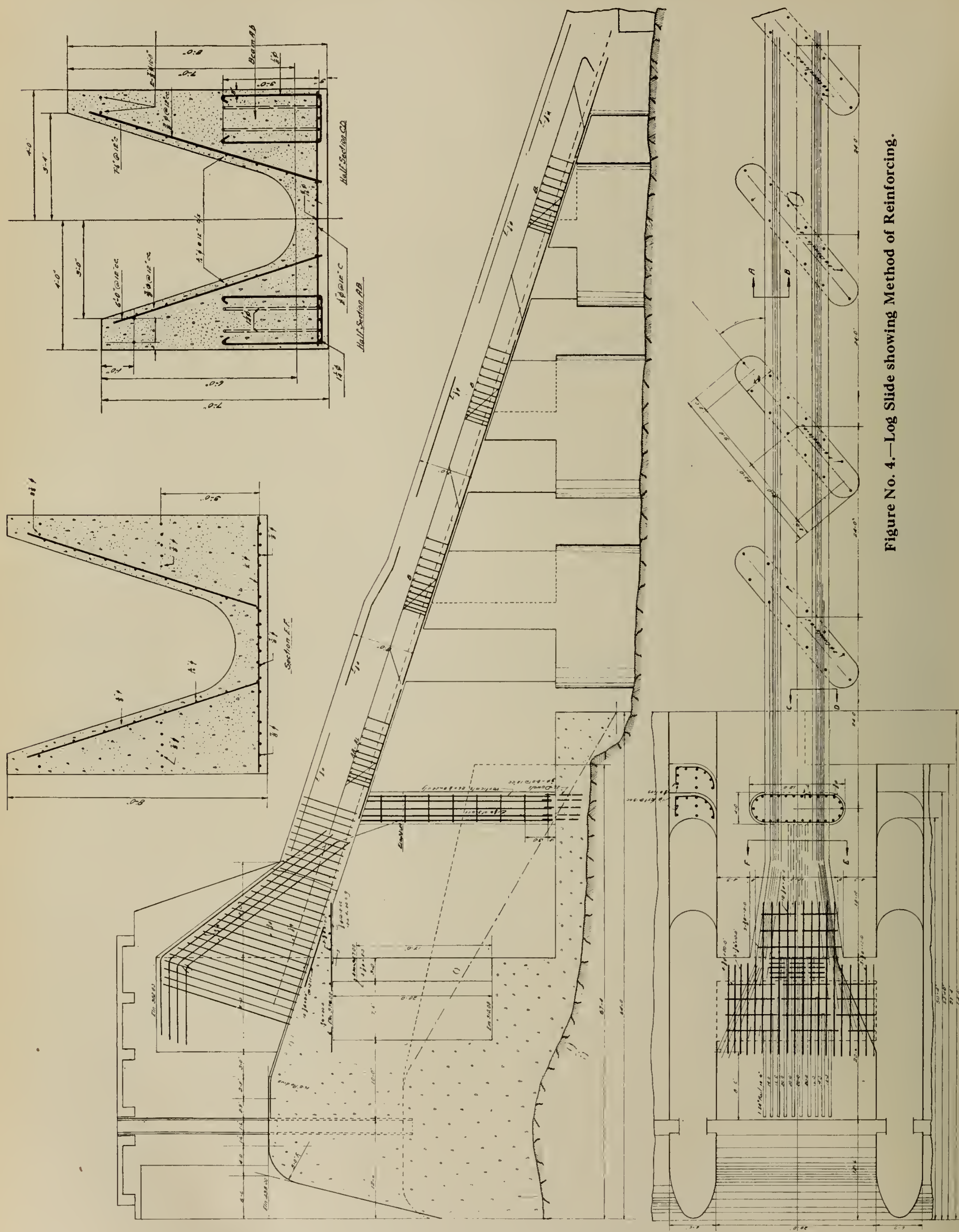

Figure No. 4.—Log Slide showing Method of Reinforcing.

government had already secured and compensated all riparian owners against damage by floodage.

The natural fall along the stretch of the Calumet channel from La Passe to the site of the old government dam was found to be approximately only 2½ feet; that is to say, that with the still water level raised to elevation 350 at the head of the island near La Passe, the corresponding water level at Bryson required to discharge the normal flow of the river would be 347.5.

During the ordinary and low water stages of the river, the water of the Calumet channel could be diverted and pass down the western channel without inconvenience or damage, but, during the high water period, owing to river improvements which had been carried out by the Upper Ottawa Improvement Commission, for the purpose of handling logs, provision had to be made to discharge a sufficient quantity of water over the cofferdam to protect these works. Accordingly, a contact was established during flood periods with the other side of the island by telephone in order that provision could be made to protect their situation by control effected through the use of flash boards mounted on the crest of this dam. By this means, any possibility of being required to pay damages to the other interested parties on the river was obviated.

Transportation

Before proceeding further with a general description of the various sections of the layout, and in view of the fact that the site of the development was situated at a point downstream some six miles below rail head, and as special facilities for transportation had to be provided for, it would perhaps be as well to give some of the details covering this problem.

All material and machinery, with the exception of timber and commissary stores obtained locally, were received over the Waltham subdivision of the Canadian Pacific Railway at Campbell's Bay, from which point three methods of transportation were possible, *i.e.*, teaming with wagons; teaming with sleighs; by water. The condition of the roads locally rendered the first option practically impossible, and the problem, therefore, resolved itself into one of obtaining freight by water in the summer time and by sleighs over the ice of the river during the winter.

For this purpose, a special steel scow of approximately 300 tons gross tonnage, measuring 100 feet long by 25 feet wide and 6 feet deep, with a suitable steel tug operated by a 50-h.p. semi-Diesel engine, were purchased, and, in view of the remote position of the site, this equipment possibly will constitute a part of the permanent installation, as in the event of additional units being installed or heavy repairs being effected it will be required.

The scow was equipped with a line of standard gauge track laid along its longitudinal centre line. The connection between this track on the scow and the track on the wharf was effected by means of a specially constructed apron hinged at the inboard end and fitted with hooks at the outboard end, which were rigidly engaged with clamps to the track on the wharf. This wharf was built with a centre wall so that the track could be raised or lowered to suit the stage of the river, and cars being placed on this siding by the railway company were then taken by light locomotive along the siding and placed on the scow.

Similar facilities were provided at the unloading end, so that the cars when unloaded in most cases could be transferred over the sections of railway built to the places where their contents would be used, thus eliminating to a maximum extent the further handling of material.

The entire equipment proved to be most satisfactory and reliable, with no major interruption being experienced in the operation of the Diesel engine. The unit cost for handling freight upon completion of the work showed as follows:—

Teaming by wagons	$1.30 per ton mile
Teaming by sleighs	0.60 " " "
Railway operation	0.45 " " "
Boat operation	0.15 " " "

These figures show that the use of tug and scow resulted in a very substantial saving in the cost of transportation, and, furthermore, allowed the handling of a much greater quantity of material than would have been possible over the roads, with the result that the construction work was considerably expedited thereby, which latter point in itself was of the utmost consideration in view of the urgent necessity of getting an additional supply of power into the city of Ottawa with the greatest speed.

The Main Dam

The dam is located immediately above the foot of the rapids at a point where the river was relatively shallow, and advantage was also taken in the construction of including a certain portion of an island in mid-stream. A restriction occurred in the bed of the river at this point, rendering the cross-section quite narrow, but, on account of the large spillway area required to discharge the spring floods, the entire crest area was required for this purpose, and in consequence the power house was not included as an integral portion of the dam, but was situated some little distance downstream and connected by a canal excavated along the western bank.

The dam is a concrete gravity section 380 feet long and 70 feet high, containing twelve sluices and a log slide of V-section, all covered by a reinforced concrete deck. The sluices are all 20 feet in width, with the crest of the dam at elevation 321, which with the normal operating level at elevation 350 places the depth of the sill below high water at 29 feet.

The water level is controlled by stop-logs handled by a 30-ton travelling stop-log hoist electrically operated by direct current supplied at 220 volts by a series of outlets placed on concrete pedestals along the downstream edge of the deck. Ornamental lighting standards have also been placed along this deck to facilitate night operation. The eastern abutment of the dam is built into and against a high bank of solid rock, and the western abutment stands alone and forms the commencement of the downstream wall of the canal which was excavated to carry the water to the forebay.

The Canal

The canal is of rectangular section 90 feet wide by 450 feet long, with the floor at elevation 313, utilizing as the western wall the natural rock face of the excavation, whilst the outstream or eastern wall is a concrete gravity spillway section 34 feet high, extending from the west abutment of the dam over a distance of 300 feet to the landing platform at the north end of the power house. This platform is 120 feet long and 30 feet wide, and is specially provided for the mooring of the scow whilst loading or unloading. A by-wash, controlled by cast iron gate sections, is also provided between this platform and the power house to facilitate the handling of trash or possible ice.

Accepting the normal operating elevation of the head water at 350, the depth of water in the canal would be 37 feet, giving a cross-sectional area of 3,300 square feet, and with the plant operating at full ultimate capacity this provides for a maximum velocity of 3.6 feet per second.

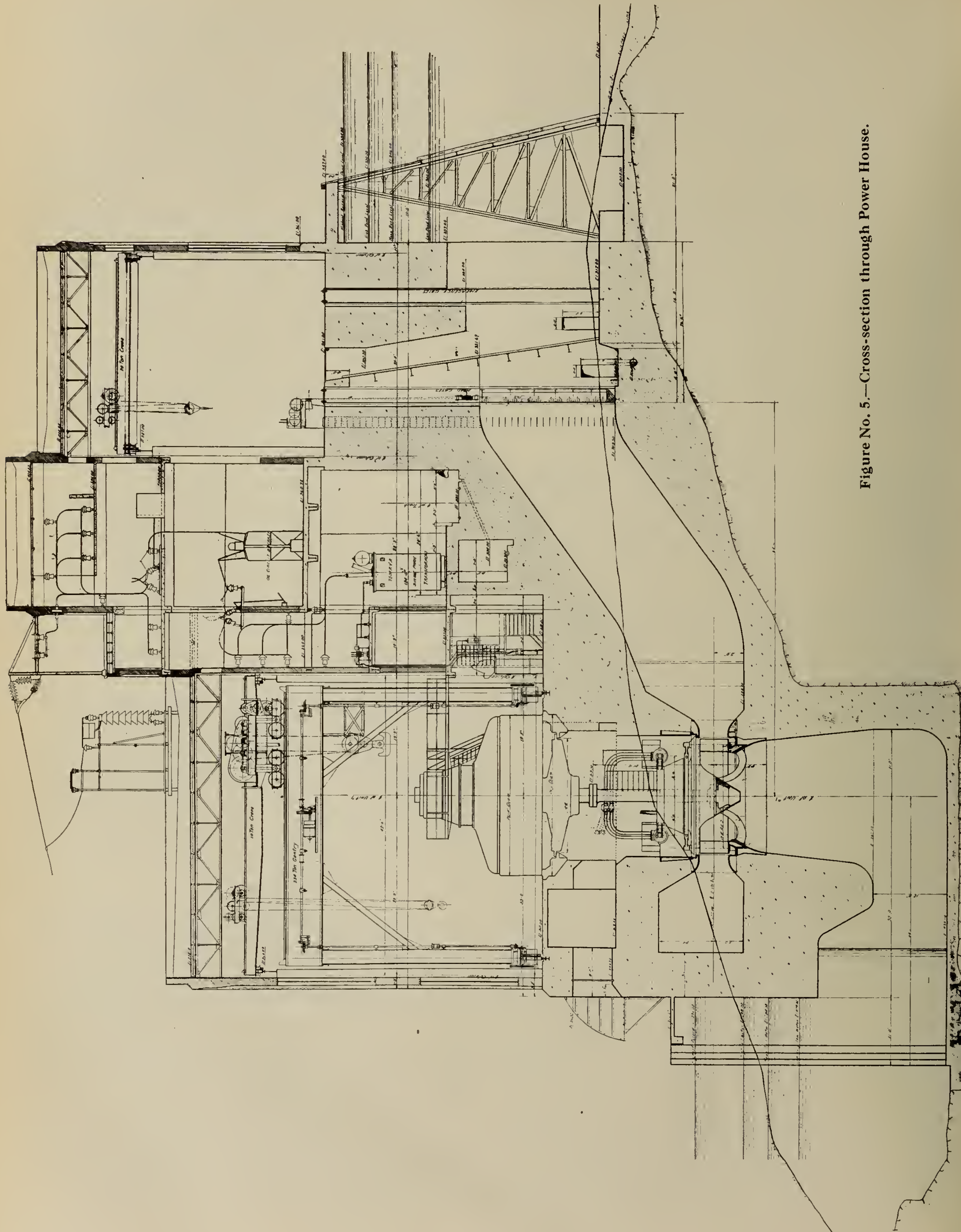

Figure No. 5.—Cross-section through Power House.

At the entrance of the canal is a row of seven piers, the tops of which are at elevation 331, spaced at intervals of approximately 14 feet, so arranged that in the event of it being desired to unwater the canal stop-logs can be inserted.

Power House

Excavation for the substructure of the power house was commenced during the latter part of December and carried down to elevation 253, with the main floor of the generator room at elevation 321. The superstructure, measuring 238 feet long by 125 feet in width, not including the platform, is of common brick faced on the outside with a high-grade buff pressed brick.

As will be noted from the cross-section plan, figure No. 6, the design of the power house is arranged in three main sections, namely, gate house, switch house and transformer compartments, and generator room, which arrangement is the outcome of requirements for stability, necessitating an over-all width of section, leaving sufficient space between the gate house and generator room for the accommodation of all necessary electrical equipment beyond the generator.

Gypsum was used throughout for the roofs on account of its lightness and the consequent saving in the weight of the roof trusses, and also due to its non-sweating properties.

A double set of racks is provided at the entrance to the intake, with the outer section of coarse spacing so as to afford a maximum amount of protection against heavy drift, which may be reached by the operators on the rack platform and carried along so as to be discharged through the by-wash at the end of the spillway section of the canal.

The gate house is completely enclosed and heated, in order to eliminate any possibilities of ice troubles occurring in the operation of the gates during the cold weather.

Gates

A full set of emergency crane operated gates, 15 feet wide by 41 feet high, is provided for one unit, which are of structural steel and of the fixed roller type. Each emergency gate is in two sections, and when not in use can be stacked on edge in the gate house..

The head gates proper, 15 feet wide by 21 feet high, are of the live roller type operated by rope hoists, with individual motor drive, and are designed to close with the full head of water on an operating unit at full load.

Cranes

A very complete equipment of four cranes was installed. For the purpose of loading and unloading material from the scow, a 50-ton standard overhead travelling crane of the rope hoist type, electrically operated, for lifting and traversing, was installed at the entrance of the power house, capable of handling any sections of the machinery and delivering same to the power house floor 57 feet below the top of the runway.

A 20-ton similar crane was also installed in the gate house, running the full length of the plant and capable of handling a complete set of emergency gates, rack sections or head gates against full hydrostatic pressure. This unit can be considered as a stand-by to any of the gate hoists in the event of failure.

A specially designed gantry crane of 272 tons capacity, electrically driven, was installed on the main floor of the power house for the purpose of handling the heavier sections of the installed machinery. This crane operates on rails of especially heavy section laid in the concrete floor, running the entire length of the power house and at the same time is arranged so that the width of the power house can also be traversed.

For the sake of convenience and as an auxiliary to the heavy gantry crane, a 10-ton standard overhead travelling crane of the rope hoist type, electrically driven, operating above the gantry crane was also installed.

Water Wheel and Generator

Although full provision has been made for the ultimate reception of three units, the initial installation consists of one vertical shaft turbine unit capable of developing, when operating under a net head of 60 feet, a total output of 25,700 h.p., or 22,500 h.p. at ⅞ gate opening at a speed of 120 r.p.m., the runner being of the usual Francis type and with a guaranteed efficiency when operating at ⅞ gate opening of 88 per cent.

The unit is controlled by an oil pressure governor driven through bevel gears from the turbine shaft, equipped with the usual hand controlled mechanism, gate opening indicator, adjustable gate limiting and the usual safety shut-down devices operating on two motors direct connected to the gate ring.

The governor specification was based upon flywheel effect of the rotating parts of 12,000,000 pounds feet squared and with a closing time of the turbine gates from full open to no load position of three seconds.

The regulation guaranteed under these conditions is as follows:—With a sudden loss of 25, 50 and 100 per cent of full load, the momentary rise in speed would not exceed 3.5, 8 and 25 per cent respectively of the final settled speed after the disturbance; the permanent variation in speed between no load and full load being set at 3 per cent. A guarantee against excessive corrosion and erosion of the runner is given for three years.

The turbine is direct connected to a 22,500-kv.a., 80 per cent power factor, 80° C. temperature rise, a.c., 3-phase, 6,600-volt generator, with direct connected exciter.

The generator is equipped with an overhead thrust bearing designed to carry a weight of moving parts and thrust amounting to 650,000 pounds. Compressed air for operating the generator brakes is supplied by a separate motor-driven air compressor. Stand-by excitation is also arranged for through the provision of a 200-kw., 250-volt, d.c. generator, direct connected for the operation of an induction motor of suitable size for continuous operation with 50° C. temperature rise.

The generator is connected, through a low voltage oil circuit breaker, directly to the low tension side of a bank of three 7,500-kv.a., oil-insulated, water-cooled, shell type, single-phase, 41,600/6,600 voltage indoor type transformers, there being no low voltage buses between the generator and transformer bank. The transformer rooms are isolated by fire doors, and similar protection against fire has been made throughout the building.

On the floor above the transformer rooms are installed the generator high tension oil circuit breakers connecting in the high tension bus, together with high tension line circuit breakers. The two upper floors are devoted to the placement of the necessary bus structures and disconnect switches. A very complete system of high tension buses and switching equipment, taking into consideration every possible contingency, has been provided for.

Provision is made for the location of a set of 46,200/-69,300-volt, 3-phase, outdoor type, oxide film lightning arresters on the roof of the generator room for each outgoing line.

At the north end of the generator room and on the main floor level are located two 5-inch double suction, single-stage centrifugal pumps, direct connected respectively to a 20-h.p., d.c. and a.c. motor, each having a capacity of from

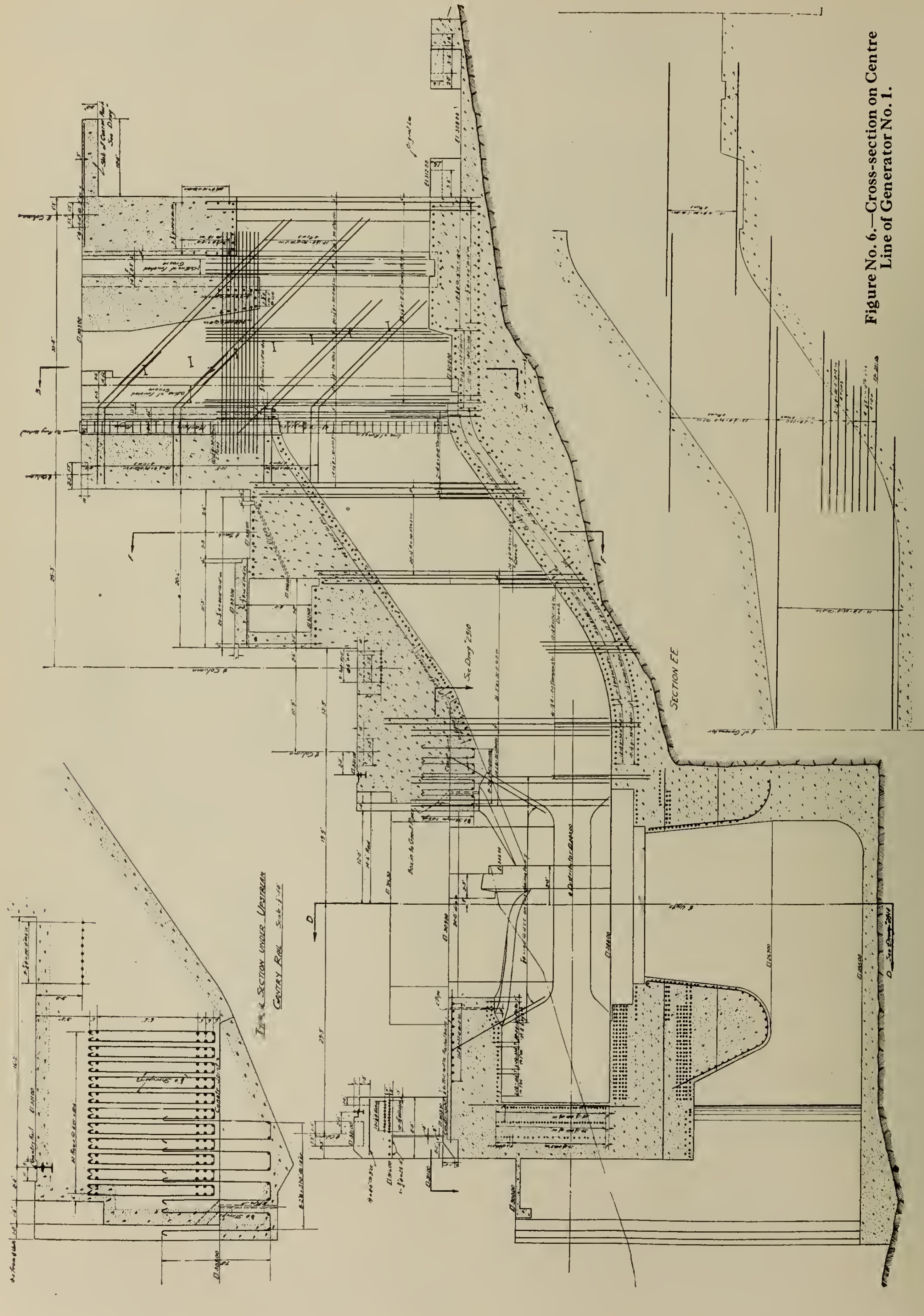

Figure No. 6.—Cross-section on Centre Line of Generator No. 1.

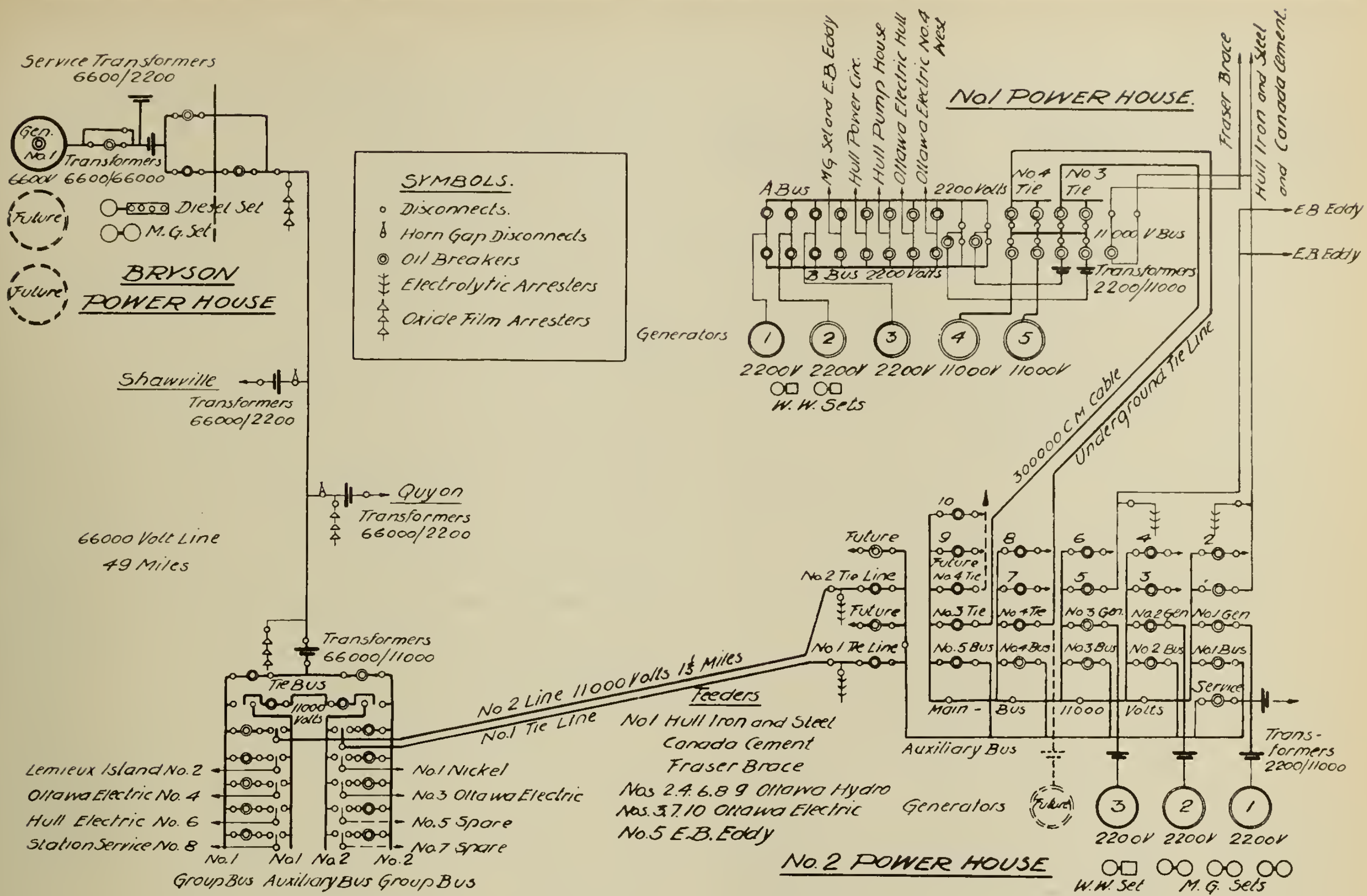

Figure No. 7.—Diagrammatic Plan of Electrical Connections.

400 to 600 imperial gallons per minute, for the purpose of supplying cooling water for transformer and all other services in the plant. Water is taken under head directly from the forebay through mechanical filters so arranged that the cleaning of the screens can be effected without interruption to the supply of water.

The heating of the building is provided through the installation of two 30-h.p. horizontal oil-fired boilers installed in a separate room, also located at the north end of the power house, operating under a pressure of 30 pounds per square inch.

Power for the operation of the motor generator set, station lighting and local plant distribution purposes is arranged for through the installation of a bank of three 500-kv.a., 6,600/2,300-volt, single-phase transformers.

All motors for the operation of the cranes, gate hoists, stop-log winch, pumps, etc., are installed for operation on direct current normally supplied from the motor-generator set, but as it was anticipated that during the commencing period of operation only one unit would be installed and one single-circuit transmission line constructed, it is apparent that in the event of trouble occurring on this line during any period while the unit might be undergoing examination or repair, the plant would be left without any source of power for the operation of the auxiliary equipment, and, with this contingency in mind, a semi-Diesel engine direct connected to 150-kw., 220-volt, d.c. generator is installed in the north end of the power house. This unit incidentally proved to be of inestimable value during the erection period and when the line was already overloaded while providing for the requirements of the contractors and operating at the low voltage of the Ottawa supply.

Quantities and Unit Costs

The following figures cover the quantities of material handled, together with the unit costs of the same on completion. These costs are exclusive of any overhead charges:—

Item	Total Quantity	Unit Cost		
		Labour	Material	Total
Cofferdams (1)	cu. yds.		cu. yd.	cu. yds.
Erection	22,410	$3 22	$1.78	$5.00
Rock Excavation	152,395	1 61	.35	1.96
Concrete (2)				
Canal wall	10,817	$1 77	$5.03	$6.80
Spillway dam, incl. forms	34,372	2.70	5.49	8.19
Power house sub-structure, incl. forms	35,885	4.38	7.06	11.44
	tons		per ton	per ton
Reinforcing Steel (3)	1,590	$23.18	$75.00	$98.18
		M.		M.
Brick Work	1,256,000	$25.00	$36.25	$61.25
	cu. yds.		cu. yds.	cu. yds.
Sand	39,100	$0.94	$0.26	$1 20
Crushed Rock (4)	73,000	$0.17	$0.07	$0 24
	cu. ft.		cu. ft.	cu. ft.
Camp Buildings	383,600	$0.04	$0.07	$0.11
Administration Buildings (5)	194,600	$0.05	$0.08	$0.13

(1) Drillers were paid 50c per hour.
Muckers " " 35c " "
Derrick operators were paid 65c per hour.
Signal men were paid 40c per hour.
Explosives, 20c per lb.
Rock was limestone and easy drilling.

(2) Carpenters were paid 55c per hour.
Cement, per bbl. $2.60.
Form lumber, $40.00 per M. average.

(3) Steel men, average 40c per hour.

(4) Installation of crushers included in plant installation account. Above unit cost covers crushing of rock and lifting of mixers.

(5) All buildings are of frame construction with pitched roof, ruberoid covered walls and roof. Average price $38.00 M.B.F.
Carpenters were paid 55c per hour.
Helpers were paid 45c per hour.

Indirect charges for the total work amounted to approximately 30 per cent, and the figures above given, therefore, can be increased by this amount to cover what would be generally termed overhead expense.

THE

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The Library of The Institute

In the August issue of the Journal there appears an announcement regarding The Institute Library at Headquarters and the service available to members through the library. At the same time, it was pointed out that the Library and House Committee had under consideration a set of rules and regulations. These regulations have since been considered and approved, and are published herewith for the information of the membership at large. Many members of The Institute have in the past made use of the library service, and it is hoped that since it has been re-catalogued and with the publication of the definite regulations, even greater use will be made of the services available through this department.

Regulations

1. The library will be open from 9 a.m. to 5 p.m. daily except Saturdays, Sundays and legal holidays. On Saturdays it will be open from 9 a.m. to 12 noon. The reading rooms will be open from 9 a.m. to 9 p.m. daily except Sundays and legal holidays. When an evening meeting is being held in the Headquarters building, the reading rooms will remain open until the close of the meeting. On Saturdays during the months of June, July and August they will be closed at 6 p.m.

2. Persons not members of The Institute may be permitted to use the reading room and reference library on presentation of credentials satisfactory to the secretary or to the assistant secretary.

3. Members have the privilege of borrowing books for a period not exceeding two weeks from the date the book is received, on deposit of $5.00, upon personal application or by written order. Upon application, at the expiration of the original two-weeks' period, books may be renewed for a further period of two weeks at the discretion of the librarian. Express charges on books sent to members are to be charged to the borrower and are to be deducted from the deposit before it is refunded.

4. Should a member fail to return a book on the date due, he shall be notified, and if the time has not been extended a charge of five cents a day shall be made for a period of two weeks, and, if not returned at the end of that time, the book may be replaced and the cost charged to the account of the member borrowing.

5. Books may be taken from the library only after they have been charged at the librarian's desk; borrowers who cannot attend personally must sign and date an order, giving the titles of the books desired. Books to be borrowed by members may be left with the janitor to be called for after library hours, if desired.

6. Encyclopaedias, dictionaries, catalogues, transactions, specifications, reports, maps and periodicals may not be borrowed, but may be consulted in the reading room. Periodicals on the table may not be taken from the reading room.

7. Members desiring to consult text books or books of reference may obtain such books on application at the librarian's desk.

8. Before leaving the building, readers must return to the librarian books or periodicals they have received for use in the reading room.

9. All persons using books remain responsible for them so long as the books are in their charge, and borrowers returning books must see that their receipts are properly cancelled.

10. Writing or making any mark upon any book or periodical belonging to the library is forbidden. Any person wilfully damaging any book or periodical in any way shall be excluded from the library and reading room and shall be debarred from the use thereof for such time as the Library Committee may determine.

11. Enquiries and requests as to technical information are welcomed, and should be addressed or made in person to the secretary or to the assistant secretary. Requests for information should be definite and indicate clearly what is desired.

12. Arrangements may be made to translate, or obtain photostat copies of technical articles, to compile data and lists of references on engineering subjects, to secure back numbers of periodicals, transactions, etc., and render assistance in similar ways. Charges are made to cover the cost of the work. Information regarding the charge for any specific service will be given upon enquiry.

Progress of Smoke Abatement

The efficacy of acts of Parliament and other legislative enactments in producing public reforms has long been an article of faith with many, in spite of the fact that laws have so often failed to produce the expected results. This seems particularly the case in regard to smoke abatement, respecting which more or less ineffective national, provincial and local ordinances exist almost everywhere.

The nuisance created by coal smoke was recognized in

England as early as the fourteenth century, when a citizen was tried, condemned and executed for burning " sea-cole " in the city of London. Later measures have, however, been of a less rigorous kind, and sixty years ago the English act in force was based on the simple requirement that engines should be " so constructed as to consume their own smoke." Under this act, offenders were actually convicted, and fined, but there was no perceptible diminution in the smoke and fog in the atmosphere.

Since that time a more moderate attitude has developed, and it is now becoming clearly recognized that if practical benefit is to result laws and ordinances regarding smoke abatement must be such as are reasonably capable of enforcement.

Extensive recent investigations, both in Europe and North America, have done much to educate the public and public authorities as to what are really practicable methods for relieving the situation, particularly in manufacturing cities. Much has been accomplished by local government authorities and by local smoke abatement societies, but there is room for improvement everywhere. Greater advances seem to have been made since the war in cities where a study of atmospheric pollution and the amount of soot and dust deposited from year to year has been made; such work has, for example, been actively carried on in London, Glasgow and Hamburg and in Pittsburgh, Cincinnati and St. Louis. In all of these cities a distinct measure of success has resulted from the efforts made.

If smoke abatement were simply an engineering problem it would present little difficulty. Experience has shown, however, that the problem is not so much how to develop methods of burning bituminous coal smokelessly as to bring about a helpful and co-operative attitude on the part of coal users and the general public. For until the public is aroused, demands smoke abatement and shows interest in it, no permanent improvement is possible. In places where the most success has been realized, active and aggressive campaigns for public education on the question have preceded the work of abatement and organized efforts to maintain the standard sought have followed it. In many cases, a regular educational campaign has been carried out by Chambers of Commerce, Boards of Trade and other business organizations in order to help to influence the large steam users and industries in general. The daily press can lend powerful aid in this direction.

In general, an effort to reduce the amount of smoke in a city must be preceded by a more or less complete survey of the conditions obtaining locally, including the amount and character of the fuel used and the nature and magnitude of the industries using it, the plants which are the greatest offenders and the location of the principal sources of atmospheric pollution.

Exact knowledge of the nature and amount of atmospheric impurities is of great value in carrying out plans for smoke abatement, and in carrying out a campaign it is of great advantage to have some idea of the relative amounts of smoke contributed to the general mass by specific industries. In some places, for example, a very large proportion of the smoke comes from locomotives, in other localities the principal sinners may be manufacturing establishments, and in some instances, particularly in England, where soft coal is burned in individual fires for house heating purposes, the smoke from fires used for domestic heating is one of the principal items.

One of the greatest steps in advance has been the general adoption by local inspectors and other authorities of the Ringelmann Smoke Scale, a chart showing four standard shades, ranging from light to black, with which an official can readily compare the colour of the smoke issuing from the chimney he is studying. Armed with this chart, an inspector has little difficulty in deciding whether or not smoke of a density or shade contravening the local ordinance is being produced.

In those cities of the United States where marked progress has been made during the past ten years, it has been found entirely practicable to enforce an ordinance which forbids the emission of smoke, the density or shade of which is equal to or darker than No. 3 of the Ringelmann chart, for a period of more than two minutes in any period of fifteen minutes. Such a provision obviously permits the production and emission of any quantity of light smoke and a considerable volume of dense smoke; but it can be enforced, and if all stacks in our cities complied with this regulation there is no question that the density of the smoke cloud which hovers over city dwellers in calm weather would be greatly reduced.

Experience has proved that fair and moderate regulations can be made effective without undue hardship upon the manufacturer, and it has also been shown, particularly in Pittsburgh, that in a large majority of cases compliance with such regulations has resulted in a material saving in fuel.

Happily, none of our Canadian cities have the reputation for smoke and atmosphere pollution formerly held by Pittsburgh, where the total solid deposits per square mile in 1923-1924 averaged 1,304 tons per annum; conditions in Montreal and Toronto, however, are undoubtedly such as to call for improvement, and it is gratifying to find that organized efforts are now being made to deal with the problem.

The Institute, through the activities of its Fuel Committee, has already been of notable assistance in this work, and the movement towards cleaner cities will undoubtedly receive the hearty support of all our members, who can render material aid in bringing about a helpful co-operative and well-informed attitude on the part of the general public.

A number of interesting articles on this subject have been published recently, among which are:—

" City Smoke Ordinances and Smoke Abatement," by S. B. Flagg, U.S. Bureau of Mines, Bulletin No. 49.

" Smoke Abatement," by Osborn Monnett, U.S. Bureau of Mines, Technical Paper No. 273.

" Smoke Abatement, Its Effects and Limitations," by H. B. Meller, Mechanical Engineering, Mid-Nov., 1926.

" Present Status of the Smoke Problem," by O. Monnett, Mechanical Engineering, Mid-Nov., 1926.

" How Cities Can Control the Smoke Nuisance," by H. B. Meller, National Municipal Review, May, 1926.

" The New Smoke-Abatement Bill," by H. B. C. Kershaw, World Power, June, 1926.

OBITUARY

James Hamilton, M.E.I.C.

It is with regret that we record the death of James Hamilton, M.E.I.C., which occurred at Belfast, Ireland, on April 20th, 1927.

The late Mr. Hamilton was born at Ardboe, County Tyrone, Ireland, on December 19th, 1874. He received his education at the Irish National Primary Schools, Belfast, and the Royal University of Ireland. From 1896-98 he was junior assistant in the office of the city surveyor at Belfast, following which he was assistant engineer on the staff of the chief engineering assistant to the city surveyor of Belfast until 1906, at which date he became a partner in the firm of Messrs. A. McDowell and Company, building and engineering contractors at Belfast. He was later engaged on surveys and preliminary plans in connection with extensions to Belfast Electric Street Railway.

In 1912 Mr. Hamilton came to Canada, and his first appointment was resident engineer on the then new sewage disposal works at Lethbridge, Alta. In 1913 he was appointed assistant engineer in the sewage department of the city of Edmonton, Alta., which position he occupied until August 1916, when he returned to Belfast, Ireland, and re-entered the department of the city surveyor of that city. He occupied this position until the time of his death. Shortly before his death, in company with the city surveyor of Belfast, he was engaged in the study of conditions in most of the large municipalities in England and Scotland, with the object of preparing a scheme of reorganization of the department with which he was connected.

The late Mr. Hamilton was elected Member of The Institute on March 21st, 1916.

PERSONALS

T. D. Pollock, S.E.I.C., has been transferred by the Bell Telephone Company of Canada from Montreal to their Hamilton office as commercial supervisor. Mr. Pollock graduated from McGill University in 1924.

J. B. Strauss, M.E.I.C., announces that the corporate name of the company of which he is president has been changed from the Strauss Bascule Bridge Company to the Strauss Engineering Corporation. Mr. Strauss remains as president of the organization.

Jas. A. McDonald, JR.E.I.C., is on the staff of the Assay office of the Bunker Hill and Sullivan Mining and Concentrating Company at Kellogg, Idaho, U.S.A. Mr. McDonald is a graduate of the University of Alberta of the year 1924, and was until recently located at Hillcrest Mines, Alta.

W. H. Barnes, S.E.I.C., who until recently has been on the staff of the department of chemistry, McGill University, has left for London, England, where he will be located at the Royal Institution of Great Britain as the holder of the Ramsay Memorial Fellowship of Canada. Mr. Barnes graduated from McGill University in 1924.

G. D. O'Connor, A.M.E.I.C., has resigned from the staff of Roger Miller and Sons, Niagara Falls, Ont., and has accepted the position of assistant engineer of Stamford township. Mr. O'Connor graduated from Queen's University with the degree of B.Sc. in 1921. During the following year he was engaged on the construction of Queen's University stadium and arena and in the latter part of 1922 was appointed assistant to the city manager and engineer of the city of Niagara Falls.

H. H. Charles, M.E.I.C., has been elected a director of the Vacuum Construction Materials Company at Hollywood, Calif., which company is engaged in general contracting and manufacture and sale of construction materials. Mr. Charles was for a number of years engaged on railway engineering work, having been resident engineer and later district engineer with the Canadian Pacific Railway Company and resident engineer with the National Transcontinental Railway. His active service during the Great War covered a period from 1915 to 1920, and upon returning to civil work he was appointed division engineer of construction, the Highway Department, St. Louis county, Minn.

W. M. Prudham, S.E.I.C., has left for Germany, where he has been sent by the Westinghouse Electric and Manufacturing Company in accordance with an arrangement for the exchange of junior members of the company's engineering staff with its associated companies. Mr. Prudham received his degree of B.A. from McGill University in 1923 and B.Sc. in electrical engineering from the same university in 1925. Since graduation he has been with the Westinghouse Company, the first year being engaged on the graduate students' course and the second year in the switchboard engineering department. According to present plans, he will be in Germany for one year, his address being c/o Direktor Beiersdorf Siemens Schuckert A.G. Charlottenburger Werke, Charlottenburg, Berlin, Germany.

Commander Angus D. M. Curry, M.E.I.C., has been appointed to H.M.C.S. Naden for duty as consulting engineer at H.M.C. Dockyard, Esquimalt, B.C. Commander Curry was born at Newcastle-on-Tyne, England, and received his education at the Royal Naval Engineering College, Keyham, England. He came to Canada in 1910 and was commissioned engineering sub-lieutenant in the Royal Canadian navy, with which his service has been continuous ever since. He was promoted to engineer lieutenant in 1912 and to engineer lieutenant commander in 1920. From February 1924 to April 1925 he was in charge of refitting light cruisers and destroyers at H.M. Dockyard, Chatham, England. Subsequently, he was assistant to consulting naval engineer, Department of National Defence, (Naval Service), Ottawa, Ont.

Paul Manning, A.M.E.I.C., Joins Staff of Welland Ship Canal

Paul Manning, A.M.E.I.C., of Peterborough, Ont., has joined the electrical staff of the Welland Ship Canal and is located at St. Catharines, Ont. Mr. Manning was born at Gateshead-on-Tyne, England, and received his engineering education at Leeds University. His early work in Canada was on survey work for the Canadian Northern Railway and the Canadian Pacific Railway during the years 1912 and 1913. For the next two years he was resident engineer in charge of construction of the Cedars-Montreal transmission line. Subsequently, he was engaged on munitions works for four years. He then returned to England and was switchboard engineer for the British Westinghouse Company at Manchester. On returning to Canada in June 1920, he was appointetd assistant switchboard engineer for the Canadian General Electric Company at Peterborough, Ont., and has been with this company since that date. Mr. Manning, while resident in Peterborough, has been very active in the affairs of the Peterborough Branch and served The Institute as secretary of that branch for over a year.

Sam G. Porter, M.E.I.C., Receives Promotion

Sam G. Porter, M.E.I.C., has been appointed manager of the Natural Resources Department of the Canadian Pacific Railway Company, succeeding Mr. P. L. Naismith, whose retirement was recently announced.

Mr. Porter was appointed assistant manager of the Department early in 1925, previous to which he was superintendent of the company's irrigation branch at Lethbridge, Alta. He had extensive and valuable experience in engineering work following his graduation from Baylor University at Waco, Texas, until coming to Canada in 1913, at which time he was appointed inspecting engineer for the Dominion government in Alberta in connection with the irrigation office of the Department of the Interior. From this position he was promoted to assistant engineer and acting irrigation commissioner, occupying that post until joining the Canadian Pacific Railway Company.

Mr. Porter, in addition to taking an active interest in the affairs of the Lethbridge Branch, was a member of the Council of The Institute for three years, 1921 to 1923, and was last year elected vice-president of The Institute representing Zone A.

Recent Additions to the Library

Proceedings, Transactions, etc.

Presented by the Societies:
- The American Society of Civil Engineers, Proceedings.
- The Institution of Mechanical Engineers: List of Members, Articles and By-Laws.
- The American Institute of Consulting Engineers: Constitution, By-Laws, and List of Members.
- The Institution of Civil Engineers: List of Members.
- The Institution of Municipal and County Engineers: Handbook 1927-1928.
- The American Society for Testing Materials: Summary of Proceedings of the Annual Report.
- The Institution of Civil Engineers of Ireland: Transactions 1925-1926.
- The American Engineering Standards Commitee: Year Book 1927.
- The Engineers' Club of Philadelphia: Directory.

Reports, etc.

Department of Trade and Commerce, Canada:
- Bureau of Statistics: Trade with Canada, Prices and Price Indexes 1913-1926.

Department of Mines, Canada:
- Mines Branch: Operators of Sand and Gravel Pits in Canada, Use of Alberta Bituminous Sands for Surfacing of Highways, Preliminary Report on the Limestone of Quebec and Ontario.
- Geological Survey: Memoir 151. Minto Coal Basin, New Brunswick, Memoir 152. St. Urbain Area, Charlevoix District, Quebec, Summary Report 1926.

Department of Labour, Canada:
- Report on Organization in Industry, Commerce and the Professions in Canada 1927.

Department of the Interior, Canada:
- Water Power and Reclamation Service: Water Resources Paper No. 50.

Department of Commerce, United States:
- Bureau of Standards: Tech. Paper 340, Coroa Fibre as a Paper-Making Material. Tech. Paper 341, A Portable Apparatus for Transverse Tests of Bricks. Sci. Paper 551, Absorption Spectra of Iron, Cobalt and Nickel. Sci. Paper 552, Transmission of Sound through Building Materials. Sci. Paper 553, Further Radiometric Measurements and Temperature Estimates of the Planet Mars 1926. Sci. Paper 554, Determination of Sulphur Trioxide in the Presence of Sulphur Dioxide.

Department of the Interior, United States:
- Geological Survey: Water Supply Paper 574, North Pacific Slope Drainage Basins.

Treasury Department, United States:
- Public Health Service, Bulletin 170, Report of Investigation of the Pollution of Lake Michigan in the Vicinity of South Chicago and the Calumet and Indiana Harbours.

Department of Legislation and Education, Illinois, United States:
- Division of State Water Survey: Bulletin 52, Investigations of Chemical Reactions Involved in Water Purification 1920-1925.

The Board of Water Supply of the City of New York:
- Report 1926.

Department of Education of Japan:
- National Research Council: Japanese Journal of Engineering 1925.

The Harbour Commission of Montreal:
- Annual report, 1926.

Bell Telephone Laboratories:
- Reprints: Toll Switchboard No. 3, Mechanism of the Absorption of Water by Rubber; Radio Broadcast Coverage of City Areas; Some Contemporary Advances in Physics XII.; A Shield Bridge from Inductive Impedance Measurements; Dynamical Study of the Vowel Sounds 11; Electromagnetic Theory and the Foundations of the Electric Circuit Theory; Impact Testing of Insulating Materials; Location of Opens in Toll Telephone Cables; Crystal Structure of Magnesium Platinocyanide Heptahydrate; Photoelectric Emission as a Function of Composition in Sodium-Potassium Alloys; Effect of Moisture on Electrical Properties of Insulating Waxes, Resins and Bitumens; The Solidus Line in the Lead-Antimony System; Microtome Methods for Preparation of Soft Metals for Microscopic Examination.

Technical Books, etc.

Presented by John Wiley & Sons:
- Concrete Building Construction, Theo. Crane and Thomas Nolan.
- Valuation, Depreciation and the Rate-Base, C. E. Grunsky, Sr., and C. E. Grunsky, Jr.

Presented by the Chemical Catalogue Company:
- Motor Fuels, their Production and Technology, E. H. Leslie.
- Chemistry of Leather Manufacture, J. A. Wilson.
- Coal Carbonization, H. C. Porter.
- Wood Distillation, L. F. Hawley.
- Shale Oil, R. H. McKee.
- Phosphoric Acid, Phosphates, Phosphoric Fertilizers, W. H. Waggman and H. W. Easterman.
- The Analysis of Rubber, J. B. Tuttle.
- Glue and Gelatin, Jerome Alexander.

Presented by D. Van Nostrand Company:
- Applied Magnetism, T. F. Wall.
- The Rayon Industry, M. H. Avram.
- The Essentials of Transformer Practice, E. H. Reed.

Presented by the McGraw-Hill Book Company:
- Properties and Testing of Magnetic Materials, Thomas Spooner.

Presented by Mr. Arthur H. Sancton:
- American Society of Mechanical Engineers: Transactions, Volume 12, 1891, to Volume 32, 1910.
- Canadian Mining Institute: Journal: Volumes 11, 12.
- Society of Engineers: Transactions, 1899 to 1909.

Canadian Engineering Standards Association Progress of Work

(First half year 1927)

Branch of Industry and Subject	Specification No.	Stage of Progress
A—Civil Engineering and Construction:		
Steel Railway Bridges	A1–1922	4R
Portland Cement	A5–1927	6R
Steel Highway Bridges	A6–1922	3R
Reinforcing Materials for Concrete	A9–1923	6R
Movable Bridges	A20–1927	5
Steel Structures for Buildings	A16–1924	2R
Concrete and Reinforced Concrete		2
Bituminous Roads		3
Block Pavements		4
Broken Stone Roads		4
Concrete Roads		3
Earth Roads		2
Foundation and Sub-Grade Preparation		2
Sand Clay Roads		4
Gravel Roads		2
Road Structures		3
Definitions of Road or Highway Terms		3
Brick Sizes		1
B—Mechanical Engineering:		
Gearing		1
Cast Iron Pipe		3
Machine Screw Threads		3
Sheet Metal Gauges		2
C—Electrical Engineering:		
Distribution Type Transformers	C2–1920	4R
Power Transformers		2
Eastern Cedar Poles for Transmission Lines	C15–1924	3R
Western Cedar Poles for Tranmission Lines		3
Canadian Electrical Code (Part I)	C22–1927	5
Electrical Overhead Crossings		1
Rating and Testing of Electrical Machinery		2
Control Cable	C21–1927	5
D—Automotive Engineering:		
Traffic Signals for Highways		4
G—Ferrous Metallurgy:		
Tests for Heavy Steel Castings		2
Methods of Sampling for Check Analysis for Rolled and Forged Steel Products		3
Forging Quality Bar Steel		3

Stages of Progress:
1. Decision made to undertake standardization.
2. Draft proposal under consideration.
3. Sent out for criticism.
4. Submitted for approval.
5. Approved for publication.
6. Published.

The latter R following the number of stage of progress indicates that the respective specification is under revision.

BOOK REVIEWS

The Port of London Yesterday and To-day

By D. J. Owen, General Manager of the Port of London Authority, Harrison & Sons, Limited, London. Buckram, 11¼ x 9¾ in., 106 pp., illustrated.

This is a very well produced and admirably illustrated work. The first part is devoted to tracing and describing the history and development of the port of London from the earliest times, before the arrival of the Romans in Britain, up to the formation in 1909 of the present governing body, the Port of London Authority, by the taking over of the various private companies operating the docks. The latter part of the book contains a description of the present accommodation provided at the various docks and the extensive improvements and additions which have been carried out in recent years under the jurisdiction of the Port of London Authority, together with a review of some of the major trades accommodated at the port and the manifold activities of the Authority.

While the book cannot be regarded in any way as a text book of dock engineering, as it does not deal with the technical side of dock construction, yet to the harbour engineer or student of terminal transportation problems—a section of engineering becoming daily of greater importance—it is well worth study, giving as it does a comprehensive description of the formation and gradual development of one of the oldest and also one of the largest ports in the world. An excellent idea can be obtained from a study of its pages of the numerous types of accommodation needed and the great variety of produce to be handled at a great modern port. The necessity for vision on the part of those in control of terminal facilities is also well brought out, as owing to the time required for harbour construction work future requirements must be foreseen and accommodation provided ahead of time if a port is to maintain its position in competition with others.

Appendices give valuable information in tabulated form as to the dimensions and depth of water of all the wet and dry docks under the Authority, also lists of the steamship lines using the various docks and tables showing the increase in the tonnage of shipping and volume of goods handled, from the formation of the Port of London Authority to the present time.

E. H. James, M.E.I.C.

Coal Carbonization

By Horace C. Porter, M.S., Ph.D. The Chemical Catalogue Company, New York, 1924. Buckram, 6 x 9¼ in., 442 pp., diagrams, $8.00.

To be asked to review, toward the end of 1927, a coal carbonization book published in 1924 is a task that may seem to savour of the superfluous. H. C. Porter's work "Coal Carbonization" is well known to those who are interested in that branch of the technology of coal. Since 1924, a lot of water has flowed under the carbonization bridges,—or, to cast the same idea in another simile, a great deal of coal has been distilled during the last three years. For example, since 1924 large advances have been made in the low temperature carbonization field, and the first International Conference on Bituminous Coal was held in Pittsburgh in November 1926.

"Coal Carbonization" is one of the varied and valuable monographs issued under the auspices of the American Chemical Society as a result of the Inter-Allied Conference of Pure and Applied Chemistry held in London and Brussels in July 1919.

The author points out in his preface that he lays his emphasis on the coking of coal and gas making at high temperature. In covering this industrial field, excellent chapters are given covering fuels and power, the nature of coal carbonization, the effect of nitrogen and sulphur during carbonization and a most complete review of by-product coking with description of apparatus.

One chapter is devoted to the field of low temperature carbonization; and an instructive review is given of the development of the art as at 1924. It is interesting to point out, however, that large advances have been made in this field since that date,—as, for example, the work of C. V. McIntire at Fairmont, West Virginia.

In the appendix are given some valuable tables of analyses, coke yields, coke production, oven sizes, coking times, coking rate on cost, etc., with a table of American by-product coke plants complete to March 1924.

Altogether, the work can be warmly commended as a reference book in its own particular field as at 1924.

Lesslie R. Thomson, M.E.I.C.

Valuation, Depreciation and the Rate-Base

By Carl Ewald Grunsky. Second Edition, Revised and Extended. John Wiley & Sons, Inc., New York; Chapman & Hall, Limited, London, 1927. Buckram, 6 x 9¼ in., 500 pp., tables, $5.00.

The first edition of this well-known treatise on valuation is now followed by a second, just off the press, in which the information and arguments relating to valuation, depreciation and the rate-base are amplified and extended. Additional tables are introduced relating to the determination of present values and approved depreciation of properties,—special attention being given to the development of a logical rate-base, the elimination under certain conditions of the necessity for consideration of depreciation in making the rate-base, and of the Unlimited Life Method in the valuation of franchised properties. The treatment of unearned increment is broad, and, while it is rightly considered that no doctrine applicable to every case can be formulated, the arguments for or against certain methods of treatment are well set forth, leaving to the judicial body concerned the application to suit existing conditions. Especially valuable features of this latest edition are the tables throughout the body of the work and in the appendix relating to present values, annuities, amortisation, expectancy, remaining value of articles and depreciation. For the student, the methods and arguments advanced should be exceedingly valuable; and for the older practitioner with experience in the fundamentals, the very original and complete tables will be found of great practical use in estimating values of property either for sale purposes or in connection with rate cases and for commercial or public properties under franchise.

R. A. Ross, M.E.I.C.

Review of Eminent Chemists of Our Time

By Benjamin Harrow, Ph.D. D.Van Nostrand Company, Inc., Buckram, 6 x 8½ in., 471 pp., portraits, diagrams, $3.00.

In the eleven short biographies found in this volume and in the short accounts of the scientific work of these modern chemical geniuses will be found a wealth of interest and romance and a wonderful record of scientific achievement. The book will particularly appeal to those who have a liking for biographies or an interest in chemistry and its progress. The author has not merely chronicled a chain of events but has given us an insight into the character and personality of his subjects. The difficulties and disappointments are told along with the successes and in several instances if dauntless courage had not combined with genius the world would have been much the poorer.

In this materialistic age when one tends to judge scientific achievement by financial results it is refreshing to have one's attention focussed on those who study science for science's sake and contribute vastly to the fundamental knowledge of our universe and the betterment of mankind. The work of such men are stepping-stones for their industrial co-workers.

The student of chemistry in particular will find a wonderful stimulus in the life story of these famous masters.

The author deserves the thanks of the scientific world for having brought together a lot of scattered information and first-hand facts which at a later date might become unavailable and which form a valuable historic scientific record.

J. R. Donald, A.M.E.I.C.

MEMBERS' EXCHANGE

Protractor for Sale

A member wishes to dispose of an 8-inch vernier protractor in good condition. Apply box No. 14-E, Engineering Journal.

Plans, Documents, Etc.

Offers are hereby solicited for certain plans, documents, and records in my possession, respecting a number of municipal works constructed between 1900 and 1919 in the provinces of Nova Scotia, New Brunswick, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia. Inventories by provinces will be sent upon application. Apply to Willis Chipman, M.E.I.C., 204 Mail building, Toronto, Ont.

BRANCH NEWS

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

On Saturday, August 20th, a visit was paid to the property of the Calgary Power Company at Seebe, some fifty miles west of Calgary. This was the occasion of a picnic for the members and their families. Although the weather man played some erratic pranks, everyone managed to have a good time. The officials of the company very thoughtfully placed the fine dining room and dance hall at our disposal, and the excellent food provided by the members' wives was demolished with an eagerness sharpened by the dismal outlook.

G. H. Morton, A.M.E.I.C., was in charge of the sports, which devolved themselves into tests of skill and relay races in the hall and ended up with dancing. However, he made the time pass with much merriment and pleasure, despite the handicap of rain. Prizes were distributed by Mrs. F. K. Beach, after which all returned by motor to Calgary feeling the better for an enjoyable outing.

MEETING OF SEPTEMBER 3RD

A meeting was called on September 3rd, to which delegates from the Edmonton and Lethbridge Branches were invited, to discuss important questions on the agenda for the plenary meeting of Council being held in Montreal on October 10th, 11th and 12th. The most important point for discussion was the policy to be pursued as regards The Institute's relationship with the various Provincial Professional Associations, and also to give the local councillors a better understanding as regards the opinion throughout the province on this and other important points. The discussion was very ably opened by S. G. Porter, M.E.I.C., who outlined with great care his suggestions for improvements in connection with the present status of The Institute and the Alberta Professional Association, as also the Provincial Associations throughout the Dominion. He dealt with the policy of The Institute in the event of changes in relationship between this body and the Provincial Associations, also the necessity for uniform requirements for admission to the various organizations. He stressed the point that engineers must agree amongst themselves if legislators are to be expected to formulate and pass acts in their interests. He also explained the need for consolidation of organizations as well as for a reciprocal inter-provincial relationship, and that qualifications for membership, in whatever organizations were eventually formed, should be the same in each province. A healthy discussion followed Mr. Porter's remarks, in which the delegates from outside points took a prominent part.

The object of the meeting was principally to convey to those councillors present the general opinion of members in the province regarding The Institute's relationship with the Provincial Professional Associations, so that they in turn might be better prepared to voice the opinions of these branches at the meeting in Montreal. No resolutions were passed, but it was the feeling of the meeting, especially in view of Mr. Porter's words, that The Institute, as a Dominion-wide representation of engineers, was the logical body to take the lead.

The branch was glad to welcome G. N. Houston, M.E.I.C., P. M. Sauder, M.E.I.C., J. Dow, M.E.I.C., G. S. Brown, A.M.E.I.C., W. Meldrum, A.M.E.I.C., and C. Raley, A.M.E.I.C., from Lethbridge; and Professor C. A. Robb, M.E.I.C., Professor R. S. L. Wilson, A.M.E.I.C., and H. R. Webb, JR.E.I.C., from Edmonton.

Dinner followed the business meeting, when the members of the various branches had an opportunity of becoming better acquainted. After dinner there was a short musical entertainment, to which Mr. Meldrum contributed with several songs, much to the enjoyment of those present. Max Bishop, Calgary's well-known humorist, rendered some of the best of his repertoire in clever style. A stunt was put over by the branch news editor, who managed to successfully pull some lively gags on those present, causing considerable laughter.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, A.M.E.I.C., Branch News Editor.

EXECUTIVE MEETING, SEPTEMBER 14TH

A meeting of the executive of the Hamilton Branch was held in the office of the city engineer, W. F. McFaul, M.E.I.C., on September 14th, six members being present. After routine matters had been disposed of, the secretary-treasurer presented his financial statement and report for the preceding financial year, as follows:—

FINANCIAL STATEMENT

November 1st, 1926, to May 31st, 1927.

Receipts

Balance forward November 1, 1926		$512.90
Rebates		212.25
Branch News		45.42
Branch Affiliate fees:		
Current	$67.50	
Arrears	75.00	
		$142.50
Journal		4.00
		$917.07

Expenses

Printing and postage	$ 57.53
Halls and refreshments	116.54
Advertising	7.50
Lecturers	6.25
Journal	2.10
Delegate—Quebec	50.00
Stenographer	50.00
Total expenses	$289.92
Balance	627.15
	$917.07

In the expense account it will be noticed that the cost of meetings is covered by the first four items, amounting to $187.82. There were eight meetings held, so that the average cost of meetings was $23.43. The receipts amounted to $404.17, of which $75.00 was arrears of fees, so that the net receipts for the year were $329.17, or only $39.25 more than the expenses. As the Prize Committee's report, proposing to offer $95.00 a year in prizes, was adopted by the branch, it will be necessary to readjust our finances.

W. F. McLAREN, M.E.I.C.,
Secretary-Treasurer.

The last year's committees were reappointed, as follows:—

Papers—Chairman, H. A. Lumsden, M.E.I.C., E. H. Darling, M.E.I.C., J. A. McFarlane, M.E.I.C., H. S. Philips, M.E.I.C., F. P. Adams, A.M.E.I.C., D. W. Callander, A.M.E.I.C.

Publicity—Chairman, J. R. Dunbar, A.M.E.I.C., E. M. Coles, A.M.E.I.C., F. I. Ker, A.M.E.I.C.

Entertainment—Chairman, A. H. Munson, A.M.E.I.C., W. D. Black, A.M.E.I.C., A. R. Hannaford, A.M.E.I.C., A. M. Jackson, A.M.E.I.C., R. J. Clench, S.E.I.C., O. W. Titus, A.M.E.I.C.

Membership—Chairman, H. B. Stuart, A.M.E.I.C., F. H. Midgley, M.E.I.C., H. G. Bertram, M.E.I.C., J. J. MacKay, M.E.I.C.

The Chamber of Commerce Engineering Committee, consisting of members of the Hamilton Branch of The Engineering Institute of Canada who are also members of the Chamber of Commerce, together with the chairman and secretary-treasurer of the Hamilton Branch, was confirmed.

Details of the meetings to be held on September 19th, 21st and 22nd were discussed. These meetings have been arranged through the Portland Cement Association, who are providing the lecturer, and will cover the design and control of concrete mixtures.

An invitation to join a trip of inspection through the Welland canal was reported by H. A. Lumsden, M.E.I.C., chairman of the Meetings and Papers Committee, and it was decided to join in the trip. October 15th was suggested as being most suitable date for the trip for the Hamilton engineers, but the exact date will have to be arranged by the Welland engineers.

An invitation from the engineers resident in St. Catharines to participate in a joint meeting with the Toronto Section, American Institute of Electrical Engineers and the Hamilton and Niagara Peninsula branches of The Engineering Institute of Canada, to be held on October 28th, was received. The Executive Committee endorsed this, but were unable to estimate the number of members of the local branch who would attend.

The attention of all members of the Hamilton Branch is to be directed to the branch prizes which are offered. The Hamilton Branch prize is offered for the best paper presented by members of the Hamilton Branch at a branch meeting before May 31st, 1928. Three Students' prizes are also offered. Papers for Students' prizes should be in the hands of the secretary-treasurer by the first week in April. It was also decided to hold a Students' meeting early in April, at which the Students offering papers in this competition will have an opportunity of delivering an oral summary of their papers before a branch meeting. A prize for technical students in the Hamilton Technical Institute is also offered. Complete details regarding Hamilton Branch prizes are publised in The Engineering Journal for February 1927.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

A course of three lectures was given by Mr. R. S. Phillips, of the Portland Cement Association, in the hall of The Engineering Institute on the evenings of September 13th, 14th and 15th on the subject of the Design and Control of Concrete Mixtures. Engineers, architects, contractors and others interested were invited to attend these lectures, and there was a good attendance each evening.

The Portland Cement Association's booklet on "Design and Control of Concrete Mixtures" was distributed to all those present, as well as printed cards for recording the practical demonstrations of the design of mixes by trial and calculation.

The lectures covered the ground very fully and practically under the following headings:—

- Requirements of good concrete.
- Fundamental water-cement ratio law.
- Elements of design of concrete mixtures.
- Water-cement ratio specification.
- Trial method of designing mixture.
- Bulking of aggregate.
- Design of mixture by the calculation method.
- Inter-relation of mix, grading, workability and strength (problems).
- Control of concrete in the field.
- Effect of factors other than proportioning on quality of concrete in structures.
- High early strength concrete.

The water-cement ratio strength law was stated as follows:—"For given materials and conditions of manipulation, the strength of concrete is determined solely by the ratio of the volume of mixing water to the volume of cement, so long as the mixture is plastic and workable." In all cases, the proper control of the mixing water is the vital factor in producing strong, durable concrete.

In order to demonstrate the "trial method of designing a mixture," the lecturer had previously procured some fine and coarse aggregate from a construction job in the city, with which he made up a trial batch designed for a strength of 2,000 pounds per square inch. The bulking of the sand was taken into account, and the bulking factor in this particular case practically demonstrated. Later, a design of mix was worked out by the calculation method, using similar materials for the same strength. In each case the slump test was checked after mixing the batch, and proved higher than that aimed at in the design of the mix, although the mix appeared to be quite workable.

The proper grading of aggregates was well explained by the lecturer. In the grading of the aggregate, he stated that it was desirable that 50 per cent should be of the average size, 25 per cent larger and 25 per cent smaller than the average size.

The fineness modulus or grading factor of aggregates was also fully covered.

In referring to the compressive strength of concrete at various ages, it was mentioned that the results of 7 days are more erratic than at 28 days. The strength continues to increase as the logarithm of its age for twenty years and probably longer.

In reference to the time of mixing, Mr. Phillips stated that in no event should this be less than one minute for mixers up to one-half yard capacity and more than a minute for larger mixers. Two minutes' mixing will add 100 pounds and five minutes 200 pounds to the strength over one minute mixing. Concrete mixed longer will also shrink less than when mixed for a short period.

In regard to mixing concrete in cold weather, the lecturer mentioned that very little hardening action takes place below 40° F., and referred to the American Society for Testing Materials requirements in this respect.

In discussing methods of securing high early strengths in concrete, the following means were mentioned:—

(1) Richer mix,	(2) Lower water-cement ratio,
(3) Drier slump,	(4) Longer mixing,
(5) Proper curing,	(6) Use of an accelerator.

Great stress was laid on the proper curing of concrete by keeping it wet for several days after setting, which may be done by sprinkling, pounding, use of damp sand, damp sawdust, (free from tannic acid), or other suitable means. The curing not only increases the strength, but also makes the concrete more impermeable and prevents cracking.

The use of calcium chloride as an accelerator, in quantity of 2 pounds to the bag of cement, has increased the strength as much as 500 pounds to the square inch.

Various points in the field control of concrete were covered by the lecturer. He stated that in measuring batches by volume, bulking should be taken into account, but if done by weight there is no necessity to allow for bulking. In this connection, the inundation method was referred to, which has proved so satisfactory for producing uniformity of measurement. In any case, the quantity of water should be measured by some fool-proof method. A mixer large enough for the job should be adopted running at 15 to 25 revolutions per minute. Hopper-bottom skips and buggies are most suitable, as they tend to increase the mixing.

Programme of Fall Meetings

The Papers and Meetings Committee of the branch have arranged a very interesting programme for the fall meetings. As the subjects are all of general interest as well as being by well-known authors, it is hoped that a large attendance will result.

The following is the arranged programme:—

Date	Subject	Speaker
Oct. 6	Arc Welding Structural Steel	By A. M. Candy
" 13	Induction Regulators	" N. D. Seaton
" 20	Replacement of Buctouche River Bridge	" Major C. S. G. Rodgers, A.M.E.I.C.
" 27	Talk by Judge St. Cyr, President Montreal Tramways Commission.	
Nov. 3	Manufacture of High Pressure Boilers	" J. O. Twinberrow, A.M.E.I.C.
" 10	Montreal Building Code	" Paul Baily, A.M.E.I.C.
" 17	McGill Student Paper.	
" 24	Stability of High Voltage System	" C. A. Nickle
Dec. 1	Vacuum Process of Paper Manufacturing	" O. Minton
" 8	Montreal-Longueuil Bridge	" P. L. Pratley, M.E.I.C.
" 15	Annual Meeting.	

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

Visit to Grand Falls Power Development

On the weekend including Labour Day, September 3rd to 5th, 1927, a number of members of the Saint John Branch travelled by automobile to Grand Falls, N.B., a distance of 208 miles by road from Saint John. The object of the visit was to inspect the hydro-electric development now under construction there.

The main party left Saint John by automobile at 2:00 p.m. on Saturday, September 3rd, and motored to Woodstock, N.B., distant 132 miles, where they stopped for the night at the Carlisle hotel. On Sunday the party made Fort Fairfield, Me., for dinner and after-

Figure No. 1.—Grand Falls Power Development—Panoramic View Looking Downstream at Dam and Intake showing Falls at End of Wing Dam above Bridge and Town of Grand Falls in Background.

Figure No. 2.—Grand Falls Power Development—View Looking Upstream at Falls and Piers of Proposed Dam.

wards continued through Maine state road to Cyr hotel, St. Leonards, N.B., where they spent the night. On Monday, Labour Day, the party left St. Leonards at 9:30 a.m. and arrived at Grand Falls at 10:00 a.m.

On arrival at Grand Falls, the party were taken in charge by A. C. D. Blanchard, M.E.I.C., resident engineer in charge of construction, and the members of Mr. Blanchard's staff of the Saint John River Power Company. An itinerary had been prepared and was closely followed, so that the various features of the construction works were viewed in turn. A stop was made on a high bank overlooking the dam and intake works, after which the party proceeded in trucks and motors supplied by the Dominion Construction Company and Saint John Power Company to the power house at the lower section of the town of Grand Falls. Here the power house under construction was viewed, also the penstock erection and concreting plant. The party then assembled in the field office, where raincoats and rubber boots were provided for those who wished to make a trip through the tunnel. Several ladies in the party went several hundred feet into the tunnel where the concrete lining had been placed and the work was comparatively dry.

The tunnel, 2,750 feet in length, extends under the town of Grand Falls, and the centre 9-foot section has been drifted through and some sections enlarged to the final diameter, 24 feet 6 inches, with concrete lining placed. The party proceeded through the tunnel and were raised in skips up the tunnel entrance shaft to the power house. Here they were joined by those members of the party who had not made the trip through the tunnel. The intake and main dam, which are under construction, were examined and various features of the work explained to the party.

Most of the party left for the return trip to Saint John. Those who remained behind saw the crib dam placed in position for the diversion of the water through part of the river where concrete piers had been completed.

Those who made the trip were impressed with the progress which had been made to date, which justified the prediction that work would be completed by mid-summer of 1928. The visit also enabled members from various sections of the branch district to meet together, and this feature of the trip was greatly enjoyed.

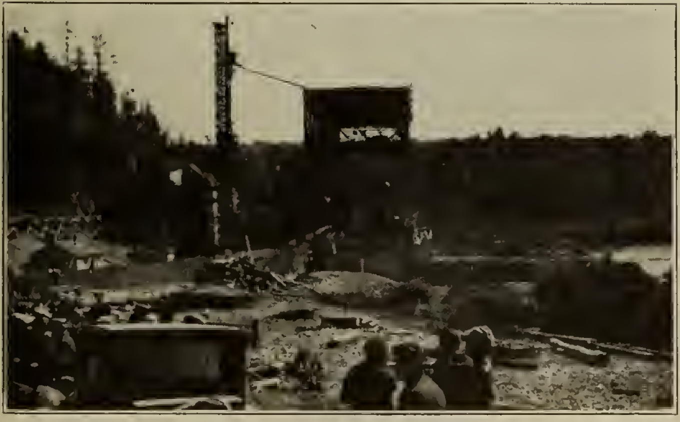

Figure No. 3.—Grand Falls Power Development—Power House under Construction.

Saskatchewan Branch

R. W. E. Loucks, A.M.E.I.C., Secretary-Treasurer.

PICNIC AT LUMSDEN

On Wednesday afternoon, August 24th, the members of the Saskatchewan Branch, accompanied by the ladies, joined with the members of the Saskatchewan section of the American Institute of Electrical Engineers in a picnic to River Park, in the town of Lumsden. The site chosen was an ideal one for a picnic. Lumsden is one of the older towns in the Regina district and its picturesque location and natural beauty added charm to the occasion. There was a total attendance of about sixty-five, including the ladies and children. A well arranged programme of sports was carried out, terminating in a soft ball tournament in which four teams were represented as follows:—

Government engineers—Stewart Young's "Provincials."
Municipal engineers—Roy McCannel's "Civics."
Telephone engineers—Bud Parker's "Hello Boys."
IX engineers—"Dutch" Macpherson's "Nondescripts."

The finals between the "Hello Boys" and the "Civics" resulted in a decisive victory for the "Civics."

The sports were followed by a sumptuous basket picnic on the banks of the Lumsden river, amongst the trees, which was thoroughly enjoyed by all present. At this time "Dutch" Macpherson made the presentation of prizes.

The picnic was ably organized and carried out by a special committee under the chairmanship of D. A. R. McCannel, A.M.E.I.C.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

The rapid progress made during recent years in electrical engineering was graphically shown in a series of moving picture films exhibited by Mr. Ian M. McLean, of the Canadian General Electric Company, Toronto, at a meeting of the branch held in the city hall on September 9th. This meeting was open to the public and was largely attended. G. C. Torrens, A.M.E.I.C., chairman of the branch, presided.

After a few introductory remarks from Mr. McLean two films were shown, illustrating with considerable detail the manufacture of transformers, from the tiny affair first constructed thirty-five years ago, weighing but twenty pounds, to the modern 100-ton giant containing 100 miles of wire, every inch of which must be cleaned and tested before being assembled in place.

The greater part of the evening was devoted to the "electrification of railways," or, as Mr. McLean put it, the "steam locomotive versus the electric," and various facts were brought out favouring the latter. A particularly pleasing film, remarkable not only for its technical interest but for its scenic beauty as well, showed the operation of a thirty-mile division of the Mexican railways before and after electrification.

In conclusion, diagrammatic and pictorial illustrations of the working of an automatic substation were thrown on the screen.

A vote of thanks, moved by G. L. Dickson, A.M.E.I.C., and seconded by B. E. Bayne, A.M.E.I.C., was tendered Mr. McLean by the chairman.

Another International Bridge

Another international bridge between the province of New Brunswick and the state of Maine is to be constructed in the near future. Tenders were recently called by the Maine State Highway Commission under an arrangement with the New Brunswick Provincial Department of Public Works for construction of the Forest City International Bridge between Forest City, Washington county, Maine, and Forest City, York county, New Brunswick. The tenders closed on September 26th, and the plans call for a 45-foot reinforced concrete slab supported on concrete abutment with stone and earth approach.

The Topographical Survey, Department of the Interior, has published a map of Yoho park showing the natural features of the park, together with the means of access to them. The map is printed in colours on a scale of two miles to an inch, with contour intervals of 250 feet. Copies may be obtained from the Topographical Survey, Ottawa, at a nominal charge.

The Westinghouse Electric & Manufacturing Company has just issued a leaflet No. 20286-A on static condensers for power factor correction on motor circuits, which contains descriptions and illustrations of the various types of condensers. The company has also issued a revised leaflet No. 20330 which gives in detail the application and construction of the type SC steel clad, single-phase, platform mounting, distribution transformers. Copies of these leaflets may be secured from any of the district offices or from the office at East Pittsburgh, Pa.

Addresses Wanted

The following is a list of members for whom there is no address on file at Headquarters, and the Secretary would appreciate any information as to the present address of any of these members.

MEMBERS

A. Angstrom
T. B. Campbell
H. G. Dimsdale
H. A. Ingraham
A. E. Johnson
J. Rocchetti

JUNIORS

F. D. Austin
Terence Clark
R. K. DeLong
G. R. McLennan
H. K. Morrison
J. H. Ryan

ASSOCIATE MEMBERS

C. R. Avery
P. I. Baker
A. R. Black
J. H. W. Bower
W. W. Christopherson
J. Erskine
J. L. Franzen
A. Gibson
E. A. Gray
P. M. Higgins
B. D. Hobbs
M. W. Jennings
R. A. Kirkpatrick
L. W. Lester
W. Matheson
C. L. McLean
W. M. Miller
C. N. Mitchell
E. B. Patterson
E. W. Pearson
G. M. Ponton
W. H. Roberts
H. H. Robertson
F. R. Smith
P. Oakley Spicer
C. F. Szammers
W. E. Tidy
J. A. Wakefield

STUDENTS

W. W. Abernethy
J. M. Allen
M. Balfour
R. G. Barbour
W. F. A. Benger
G. F. Bryant
A. J. Chabot
C. Climo
C. S. Finkle
M. Fox
C. H. Frid
J. W. S. Gibbs
G. J. Hamilton
C. E. Lewis
W. J. Lewis
N. T. MacDonald
D. A. MacRae
R. G. H. McLeish
J. H. Oliver
L. L. Roquet
R. C. Shanly
C. Weisburgh
F. R. Whatmough
F. E. Wilson
D. Wyatt

(Photo by Fairchild Aerial Surveys Company)

Aerial Photograph of Dams on Grand Discharge, Lake St. John, Quebec.

Preliminary Notice

of Applications for Admission and for Transfer

September 17th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in October 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ARCHIBALD—SAMUEL WALLACE, of Seaforth, Ont., Born at Seaforth, Ont., May 13th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1922, O.L.S., 1925, grad., Faculty of Educ., U. of T., 1914, registered Prof. Eng., 1927; 1919 and 1920 (summers), chainman, twp. outline survey and instrumentman on location work, res. engr. on constrn. with Lang & Ross, Sault Ste. Marie; 1921 (summer), instrumentman, twp. outline survey, with H. J. Beatty, Pembroke, Ont.; 1922 and 23 (summers), instrumentman i/c party, twp. outline survey, with J. W. Fitzgerald, O.L.S., Peterborough; instructor in engrg. drawing and maths., Sault Ste. Marie Tech. School; 1923-24, demonstrator, dept. of drawing, U. of T.; 1924, instrumentman i/c party, highway location, lake Superior east shore, Lang & Ross.; 1925 to date, private practice in engrg. and surveying, Seaforth, Ont.

References: J. L. Lang, K. G. Ross, J. R. Cockburn, G. E. Stephenson, G. A. McCubbin.

CHAPPELL—MELBOURNE RUSSELL, of Sydney, N.S., Born at Chappells Mills, N.S., Aug. 18th, 1887; Educ., 1904, grad., Windsor, N.S., Academy, 1905, Ont. Business College, Belleville, Ont., 1915, arch. drawing with I.C.S.: 1908-09, in office and did some quantity estimating with Otis Staples Lumber Co., Calgary; 1910 to date, with Chappell Bros. & Co., Ltd., as follows: 1910-13, dftng, estimating and clerk of works; 1914, i/c office duties in connection with constrn. work, also asst. general supt.; 1916-21, constrn. supt. in full charge of all constrn. work; 1921 to date, general mgr. and vice-president.

References: A. P. Theuerkauf, R. M. McKinnon, H. B. Gillis, W. S. Wilson, J. P. Cotter, W. E. Clarke.

DANN—NORMAN LESLIE, of Outremont, Que., Born at Montreal, Feb. 7th, 1889; Educ., Univ. of Kansas school of engrg., 1909-10; 1911 to date, with Northern Electric Co., Montreal, as follows: 1911-13, dfting and inspecting related to wire and cable circuits; 1913-17, general engrg. of power, telephone, fire alarm and submarine cables and miscellaneous wires and cables; transmission and distribution problems related to installation and utilization of wires and cables; 1917-19, cable engr. i/c engrg. cable installations, etc.; 1919-26, head of cable design division; 1926 to date, acting cable engr.

References: W. S. Vipond, W. C. Adams, E. A. Ryan, W. C. M. Cropper, I. F. Roche, J. D. Hathaway, A. J. Lawrence.

DUNN—CHARLES PUTNAM, of Portland, Oregon, Born at Marcus, Iowa, Sept. 28th, 1886; Educ., in June 1909 completed third yr. at Washington State College; prior to 1909, 5 mos. chainman on ry. surveys, 3 mos. transitman on ry. surveys and 15 mos. as transitman and inspector on hydro-electric constrn.; June and July 1909, bridge engr. under J. H. Kennedy, Vancouver, B.C.; 1909-10, secy. to chairman of Appraising Comm'n, Coeur d'Alene Reservation, Idaho; 1910-11, i/c land survey party, U.S. Indian Service; 1911-12, field engr. on paving and sewers, Spokane, Wash.; 1912-13, asst. field engr. in charge of party, G. N. Ry.; 1913-14, hydro-electric surveys and estimates, G.N.R.; 1917-19, dftsman, Skinner & Eddy Corp., Seattle; 1914-16, i/c party valuation surveys, G.N.R.; 1916-17, i/c party hydro-electric surveys and office work, G.N.R.; 1919-20, i/c scientific dept., Skinner & Eddy Corp., Seattle; 1920-22, hydro-electric design, Skagit project, city of Seattle; 1922 to date, with Portland Electric Power Co.; 1922-26, i/c electrical, mechanical and structural design; 1926 to date, ch. engr.

References: J. P. Newell, R. L. Hearn, J. B. Holdcroft, J. H. Kennedy, R. J. Durley.

KAYSER—NICHOLAS JAMES, of Montreal, Que., Born at Little Suamico, Wis., Apr. 1st, 1885; Educ., B.S.G.E., Wisconsin Univ., 1910; 1902-06, machinist apptce. course; 1908 (summer), chainman, rodman and instrumentman; 1909 (summer), transitman with city engr. of Green Bay; 1910 to date, with Fraser Brace Engrg. Co., as follows: 1910-13, contractors' engr., Shelbourne falls devel.; 1913-15, asst. supt., first Cedars devel.; 1915-24, supt. at Hell Gate bridge cont., second Cedars hydro cont. and N.Y. hbr. dry dock cont.; 1924 to date, asst. to Major Brace, general supt. and i/c estimating, organizing, etc.

References: J. L. Busfield, J. H. Brace, J. A. McCrory, S. Svenningson, C. E. Fraser, G. C. Clarke.

MERSEREAU—JAMES ALEXANDER, of Grand Falls, N.B., Born at St. George, N.B., Dec. 25th, 1906; Educ., high school, I.C.S. courses in surveying and mapping and civil engrg.; transmission line and storage work with N.B.E.P. Comm., Grand falls development; 1926 to date, with H. G. Acres & Co. as dftsman on Grand falls devel.

References: A. C. D. Blanchard, G. H. Lowry, T. V. McCarthy, H. G. Acres, R. L. Hearn.

ROBERTS—JAMES FRANK, of Mount Royal, Que., Born at Shullsburg, Wis., Sept. 1st, 1891; Educ., B.S. in M.E., Univ. of Wis., June 1918; 1919-26, with Allis-Chalmers Mfg. Co., as follows: 1919-22, testing engr., tests in field and lab. under N. M. White; 1922-24, sales engr., hydraulic dept.; 1925-26, sales engr. i/c all Canadian work for hydraulic dept.; 1927, hydraulic engr. i/c hydraulic design of new plants and operation of old plants under J. S. H. Wurtele with Power Corp. of Canada.

References: J. S. H. Wurtele, J. H. Trimmingham, J. M. Robertson, H. G. Acres, R. L. Hearn, T. H. Hogg.

WINSOR—ROLAND BLANDFORD MAREL, of Quebec, Que., Born at Greenspond, Nfld., Aug. 12th, 1904; Educ., B.Sc., McGill Univ., 1927; 1924 (6 mos.), telephone switchboard installation, Avalon Telephone Co., Ltd., St. John's Nfld.; 1925 (6 mos.), contractors' field engr. with W. I. Bishop, Ltd., on dry dock constrn. for Nfld. Govt., responsible for all instrument work and general inspection of forms, concrete reinforcing, etc.; 1926, contractors' field engr. with W. I. Bishop, Ltd., on paper mill constrn. for St. Anne Paper Co., Beaupre, Que.; 1927 (since grad.), construction engr. with W. I. Bishop, Ltd., on paper mill constrn. for Anglo-Canadian Pulp & Paper Mills, Ltd., Limoilou, Que.

References: W. I. Bishop, A. B. McEwen, H. M. Mackay, H. L. Trotter, L. Kingston, H. W. McKiel, E. Brown.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

BENNETT—CHARLES SAMUEL, of Paugan falls, Que., Born at St. John, N.B., Sept. 5th, 1891; Educ., B.Sc., Univ. of N.B., 1912; 1912-15, jr. asst. engr., Dept. of P.W. Canada, St. John; 1919-1920, asst. engr., D.P.W.; 1920-21, field engr., N.Y. Harbour Drydock Co.; Apr. to Sept. 1921, field engr., N.B. Hydro-Electric Comm'n.; 1922-25, St. John Drydock & Shipbldg. Co.; Mar. to July 1925, Hydrolithic Waterproofing Co., N.Y.; July to Oct. 1925, structural design, Electric Bond & Share Co., N.Y.; 1925 to date, Fraser-Brace Engrg Co., Ltd., on Chelsea, Farmers rapids and Paugan falls developments.

References: F. G. Goodspeed, E. G. Cameron, L. R. Weston, F. S. Small, W. J. Johnston, A. G. Tapley.

CAMPBELL—ROBERT ARTHUR, of Assiniboia, Man., Born at Winnipeg, Man., Aug. 25th, 1899; Educ., Grade 11, Kelvin High School, Wpg., I.C.S. course in civil engrg.; 1917, stakeman, 1918, rodman, G.W.W.D., Wpg.; 1919, rodman, C.P.R.; 1920 to May 1927, instrumentman, C.P.R. constrn. dept.; at present, res. engr., C.P.R. constrn. dept.

References: J. R. Paget, W. A. James, T. C. Macnabb, N. A. Link, T. F. Francis.

JOB—STANLEY ROBERT, of Niagara Falls, Ont., Born at Hamilton, Ont., Aug. 14th, 1890; matriculation to S.P.S., Toronto, Hamilton Art and Technical Schools; asst. designer in hydraulic dept. of H.E.P.C., 1920-22; asst. designer of mill bldgs., Acheson Graphite Co., Niagara Falls, N.Y., 1925-26; asst. mech. engr. and res. engr. on constrn. of elevator at Port Colborne for Dept. of Rys. and Canals, 1924; asst. designing engr. on bldg. of Can. Shredded Wheat Co., N.Y., 1926-27; at present, designing engr. and dftsman for L. & P. Mfg. Co., Niagara Falls, Ont.

References: L. L. Gisborne, R. P. Johnson, E. H. Darling, J. C. Moyer, F. Mason, S. R. Frost.

MACDONALD—JAMES WILLIAM, of Talara, Peru, Born at Green Hill, N.S., Nov. 25th, 1893; Educ., 1911-14, first three yrs. of Science course at Dalhousie Univ., 1916-17, one year in elect'l engrg., N.S. Tech. College; 1913-14 (summers), surveying for Halifax Power Co. on proposed hydro-electric development; 1915-16, contractors on constrn. of Halifax terminal—surveying, dfting room and i/c odd jobs on constrn. work; 1917-26, with Imperial Oil Refineries, Ltd., as follows: 1917-22, ch. dftsman, with outside work, such as survey work and layout of plant, bldgs., etc.; 1922-26, plant engr., responsible to supt. and ch. engr. at Sarnia, Ont.; 1926 to date, ch. engr. with Int. Petroleum Co., Talara, Peru, in addition to plant i/c native town of about 4,000 population and 50 foreign staff houses.

References: F. R. Faulkner, J. L. Allan, J. S. Misener, K. L. Dawson, W. P. Morrison, F. C. Mechin, H. W. L. Doane.

MAXWELL—GEORGE DEAN, of Toronto, Ont., Born at St. Stephen, N.B., Sept. 13th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1921; May to Oct. 1909, chainman for A.J. Hill, C.E.; 1910-11 and May to Dec. 1913, chainman and rodman, C.N.P. Ry.; 1915-16, rodman, Toronto Hbr. Comm.; 1917-20, timekeeper with Jackson Lewis Co., Ltd., I.M.B. and N. McLeod, Ltd.; May to Sept. 1921, concrete inspector, H.E.P.C.; 2 mos. acting res. engr., C.N.P Ry.; Jan. to Dec. 1914, asst. to engr. on hbr. works, New Westminster, B.C.; May to Dec 1916, computer of estimates, Toronto Hbr. Comm.; 1921-22, demonstrator in engrg. drawing and asst. to secy., faculty of applied science, U. of T.; 1923 to date, asst. to supt. of bldgs and grounds, U. of T.

References: A. D. LePan, G. T. Clark, C. R. Young, J. R. Cockburn, H. E. T. Haultain.

ROBERTSON—ROBERT McFADZEAN, of Lachine, Que., Born at Kilmarnock, Scotland, Dec. 27th, 1893; Educ., B.Sc., McGill Univ., 1920; 1909-13 and summers of 1914 and 15, structural drawing office of Dom. Bridge Co., Ltd., as dftsman and checker; 1916-19, overseas with 3rd Field Co. and 3rd Batt., Can. Engrs., rank captain; 1920-23, bridge dept., C.P.R., design of steel and concrete structures; 1923 to date, structural designer with Dom. Bridge Co., Ltd., on design of all classes of steel structures, i/c design of steel work for new Royal Bank bldg.

References: F. P. Shearwood, LeR. Wilson, P. B. Motley, A. R. Ketterson, D. C. Tennant, C. W. Burroughs.

ROSE—JOHN THORBORN, of Winnipeg, Man., Born at Toronto, Ont., Sept. 4th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1915; 1917, aero pilot, R.F.C., and graduated in aeronautics and aerial navigation; 1915-19 and 27, hydrometric, hydrographic, water power and Dom. Land Surveys for power reserve, asst. to res. engr. on river channel rock cut and power house constrn., rating of water power wheel installations, asst. engr. on hydrographic land and power surveys; 1920, joint charge in field on ice conditions investigation for large power development; 1921, asst. in location survey for pipe line; 1925, asst. to res. engr. for rock cut and power house constrn.; 1915-23 and 26, hydrographic work; at present, asst. engr. on International Hydrographic Aerial Survey, using vertical aerial photographs.

References: J. T. Johnston, S. S. Scovil, C. H. Attwood, T. H. Dunn, G. G. McEwen, E. B. Patterson.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

BROWNELL—GEORGE WILSON, of Northport, N.S., Born at Amherst Beach, N.S., Oct. 4th, 1898; Educ., B.Sc., N.S. Tech., 1925; Nov. and Dec. 1924, instructor at auto night school at N.S. Tech.; Aug. 1925 to Nov. 1926, elect'l tester for Westinghouse Electric Co., East Pittsburgh, Pa.; Aug. to Sept. 1925, tester of circuit breakers; Sept. 1925 to June 1926, tester of control equipment; June to Nov. 1926, tester of automatic switching and substation equipment; 1926 to date, with Electro-Motive Co. of Cleveland, Ohio, as gas-electric motor car demonstrator and electrical "trouble shooter."

References: W. G. Hardy, W. F. McKnight, D. W. Munn, F. R. Faulkner, A. G. Sutherland.

CLUFF—HAROLD DAVID, of Aklavik, N.W.T., Born at Killarney, Man., Aug. 31st, 1898; Educ., B.Sc., Univ. of Man., 1924; radio engrg. training as officer in the R. Can. Corps of Signals; 3 summers, elect'l and mech'l work with C.P.R. at Wpg., Man.; 1924-25, officer i/c radio station, Camp Borden, Ont.; 1925-26, asst. signal officer, radio stations, Man. system operated by Dept. of Nat. Defence; 1926 to date, officer i/c radio stations operated by Dept. of Nat. Defence in western Can. Arctic.

References: E. P. Fetherstonhaugh, J. N. Finlayson, W. A. Steel, R. W. Moffatt, N. M. Hall, A. McNaughton.

DAVISON—JOHN LAURENCE, of Hantsport, N.S., Born at Hantsport, May 16th, 1900; Educ., B.Sc., N.S. Tech. Coll., 1925; 1919-21, electrician for town of Hantsport; 1921 to 1925 (summers), electrician in Hants county, house wiring and pole line work; 1925, rodman for Int. Paper Co., Three Rivers, foreman electrician, Can. Comstock Co., Three Rivers; 1926-27, i/c electrical work for Can. Comstock on Can. Celanese Co., Drummondville.

References: H. W. McKiel, W. F. McKnight, R. P. Freeman, J. H. Reid, G. L. Bockus, A. I. Cunningham, F. L. West.

DION—J. EDGAR, of Montreal, Que., Born at Ottawa, Ont., May 6th, 1899; Educ., B.Sc., May 1926; 1919-20, asst. chemical analyst with Brit. Am. Nickel Corp., Deschenes, Que., plant for recovery of nickel by electrolytic deposition method; 1920 (summer), analyst doing quantitative analysis on customs material, Dom. Govt. Customs Chemical Lab., Ottawa; asst. to res. engr., Dept. of Public Highways, Kingston, Ont.; 1921 and 1922 (summers), i/c special road survey party, Dept. Public Highways, Ont.; 1922-23, design & dfting on hydraulic turbines and valves, Dom. Engrg. Works, Lachine; Jan. to Oct. 1924, engr. doing cost distribution, supervision, etc., Texas Constrn. Co., Houston, Texas; 1925 (summer), cadet engr. working on and studying transmission constrn. and mtce. power load, etc., Penn. Power & Light Co.; June 1926 to July 15, 1927, Mtl. Engrg. Co., Ltd., Mtl., Que., estimating surveys and studies on engrg work; at present, with same Co. i/c field survey in Bolivia, S. Am.

References: J. H. McLaren, J. T. Farmer, C. M. McKergow, E. Brown, C. W. Allen, K. H. Smith.

FORD—ALBERT EDWARD, of Montreal, Que., Born at Waltham Abbey, England, Jan. 17th, 1901; Educ., public school, 3 yrs. night classes maths. I.C.S. mechanical engrg. and electrical engrg.; 1 yr. machine shops; 9 yrs. mechanical dftsman; 1920-21, ch. dftsman, plant dept., Can. Car & Fdry. Co.; 1924 to date, with Bell Telephone Co., as: 1924-25, ch. dftsman; at present, asst. field engr.

References: J. E. Daubney, L. McCoy, V. C. Jones, G. M. Hudson, W. S. Atwood.

SHIELDS—STANLEY, of Peterborough, Ont., Born at Belfast, Ireland, Aug. 17th, 1899; Educ., B.A.Sc., Univ. of Toronto, 1924; 1918, R.A.F.; 1919, constrn. work, H.E.P.C.; 1924-25, C.G.E. test course; 1925 to date, induction motor engr., C.G.E. Co.

References: A. B. Gates, W. M. Cruthers, W. E. Ross, B. L. Barns, P. Manning, V. S. Foster.

SNYDER—HORACE H., of Hydro, Ont., Born at Needham, Mass., Oct. 19th, 1899; Educ., mech. and civil, Queen's Univ., 1926; 1918-19, rodman on hydrographic survey; 1919-21, instrumentman on hydrographic surveys and power plant constrn. with H.E.P.C. on Nipigon river; 1922, with Temiskaming and N. Ont. Ry. as instrumentman; 1923 (summer), instrumentman with H.E.P.C. and hydrographic and preliminary power plant surveys and power plant constrn.; 1925 (summer), ch. of party for H.E.P.C.; 1924 (summer), ch. of party for H.E.P.C.; 1926 to May 1st, 1927, i/c field dfting office of H.E.P.C. on preliminary survey work and constrn. of power house and dam at Alexander Landing; at present, instrumentman on hydraulic earth fill dam constrn. at Alexander power development.

References: O. Holden, J. N. Stanley, W. S. Orr, S. B. Clement, W. P. Wilgar, L. T. Rutledge.

STEWART—DONALD, of Lakeside, Que., Born at Inverness, Scotland, Oct. 30th, 1899; Educ., B.Sc., McGill Univ., 1925; 1923 (summer), dftsman, Northern Electric Co.; 1924 (summer), electrcian's helper, Shawinigan Engrg. Co.; 1925-26, central office repairman, Bell Telephone Co.; 1926 to date, dial system equipment engr., Montreal division, Bell Telephone Co.

References: H. M. Mackay, C. V. Christie, G. A. Wallace, W. H. Slinn, J. L. Clarke, A. M. MacKenzie.

TOUPIN—VALERIEN, of Montreal, Que., Born at Montreal, Jan. 25th, 1899; Educ., B.A., Laval Univ., 1919, B.A.Sc., C.E., Ecole Polytechnique, 1925; 1924 (summer), Dom. Bridge Co.; 1925-27, lab. for testing materials, city of Montreal; May 1927 to date, St. George and Ganvreau, Ltd.

References: H. L. St. George, J. E. Blanchard, A. Frigon, A. Duperron, J. E. Gill, T. J. Lafreniere.

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Induction Regulators

The Theory of Induction Regulators, Special Features of their Design and Construction with Notes on their Selection, Operation and Application

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Paper read before the Montreal Branch of The Engineering Institute of Canada, October 13th, 1927

Induction regulators, as built at the present time, consist of two cores, one arranged on a shaft to rotate inside the other, which is stationary. The cores are both made up of sheets of steel, punched to the required shape, and piled one above the other. The rotor core is piled on, and held in place by the shaft, suitable flanges being used to hold the sheets tightly together. The stator core is usually held in place by a cast iron spider. As a rule the core has a height considerably greater than its diameter. Slots running vertically in both cores are used for holding the windings. Figure No. 1 shows typical punchings for a single-phase regulator.

Top and bottom castings are fastened to the stator spider, each containing a bearing for the shaft of the rotor. The shaft projects through the upper bearing but the lower bearing is closed at the bottom and supports the rotor at this point. The stator, and the bottom and top parts, are securely bolted together and it can be seen that when the rotor is assembled a rigid and compact unit is secured, which is easily suspended or otherwise supported in a tank.

The tank serves as an oil container and as protection for the working parts of the regulator. Various types are used but an excellent one has lately been designed which has many desirable features. It is a boiler plate tank with flattened tubes, which combines excellent cooling properties with great strength and compactness.

Some of the smaller sized regulators employ a somewhat different construction, in that a substantial cast iron tank is used, which also acts as a spider for holding the stator punchings.

The windings are placed in slots running vertically in the adjacent surfaces of the two cores. One of the windings, usually the rotor, is connected across the feeder and the other is connected in series with the line or feeder. In single-phase regulators, a third winding, usually called the short circuited winding, is placed on the rotor with its plane at right angles to that of the main rotor winding.

The operating mechanism for automatic regulators consists of a motor, brake, relay switch and limit switch, with suitable gearing for rotating the rotor, all mounted on the cover of the regulator. A large gear, usually referred to as the segment gear, is keyed directly on the rotor shaft, which, as above mentioned, projects through the cover. This large gear is operated by means of a worm gear which in turn is operated by the motor through a set of spur gears.

The relay switch has a set of coils controlled by the contact making voltmeter contacts and is really a *DPDT* switch for operating the motor in either direction. The limit switch is so arranged that as the regulator segment gear reaches the end of its travel one side of the switch is tripped by means of tripping lugs on the segment and this stops the motor. This insures that the rotor will not over travel.

In order to insure that the regulator rotor will stop practically as soon as its circuit is cut, a brake is provided which operates on a small brake wheel on the motor shaft.

The motor and brake are supplied with current from a suitable low voltage circuit usually 110 or 220 volts. The motor is preferably three-phase, although in special cases single-phase or direct current may be used.

In addition to the above mentioned items, automatic regulators require a contact making voltmeter with a potential transformer connected to the feeder side of the line. This voltmeter essentially consists of a pair of contacts, one of which closes when the feeder voltage rises above normal, and the other closes when the voltage drops below normal. These contacts operate the relay switch which in turn operates the regulator rotor through the motor and gears.

Line drop compensators are also used and by means of them the correct line drop compensation can be obtained at some predetermined point on the feeder regardless of the load. They consist of a reactance and resistance adjusted so that they correspond to the reactance and resistance of the line and are operated from current transformers to regulate the voltage applied to the contact-making voltmeter.

Theory of Induction Regulators

The induction regulator is, in principle, a veritable ratio transformer having two separate and distinct windings, and also separate cores, one being capable of being revolved with respect to the other. One winding is placed on each core. These windings are in effect polar windings, and with a given pole of the rotor winding opposite a similar pole of the stator winding, the regulator will " boost " the voltage when properly connected to a feeder. Revolving the rotor 180° from above position in a two-pole regulator will " buck " or lower the voltage. Between these two extreme positions the regulated voltage varies gradually as the rotor is revolved.

The vast majority of induction regulators built are two-pole, and it is to be understood that two-pole machines are referred to in these pages unless other types are expressly mentioned.

Single-Phase Regulators

A single-phase regulator has a rotor core constructed somewhat like a large a. c. generator field coil, with a shaft running through it the long way parallel to the plane of the winding. The details of the construction, of course, are quite different but the field coil conception is of some assistance in working out the action. The arrangement of the rotor and stator cores and windings is shown diagrammatically in figure No. 2.

As the excitation is single-phase the magnetizing flux is an alternating one and its direction is always perpendicular to the plane of the exciting winding. The secondary or stator core and coils are stationary, and as the rotor which contains the exciting winding is rotated the amount of exciting flux which threads the stator winding is changed and consequently the induced voltage in the stator is varied. When the stator flux is in same direction as the rotor flux the regulator is in the " maximum boosting " position, but when the fluxes oppose each other, then the machine is said to be in the " maximum lowering " position. These positions are 180° apart. When the planes of the coils are at right angles, that is, when the flux from one winding has no effect on and does not thread the other winding, we have the " neutral " position which occurs half-way between the above positions.

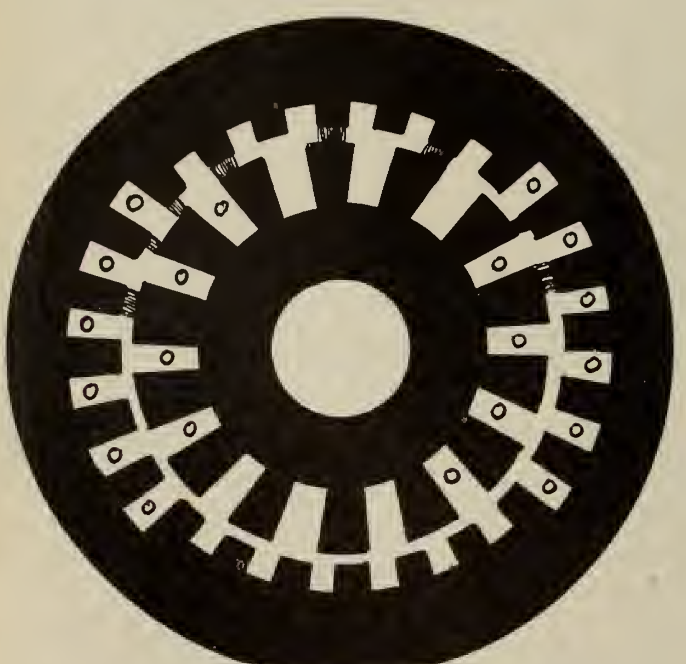

Figure No. 1.—Punchings for Single-Phase Induction Regulator.

The rotor also contains another winding called the " short circuited " winding which, as its name implies, is short circuited on itself. The object of this winding is to equalize the reactance and the losses of the regulator in its various positions of boost and lower.

This winding is wound on the rotor at right angles to the main rotor winding and accordingly the two windings have no effect on each other magnetically. It is also true that when the machine is in either maximum position, the short circuited winding is not affected by the flux due to load currents in the stator winding. However, as the rotor is turned from either maximum position, the short circuited winding gradually is more and more affected by the flux, until, in the neutral position, practically all of the flux produced by the stator current threads this winding.

Hence in the neutral position the stator winding is practically short circuited and the impedance volts, or the voltage necessary to force the feeder current through the stator, will be small. This is very desirable as a voltage drop is not wanted in this position.

The effect of this winding is gradual, because as the main rotor winding is turned out of inductive relation to the stator winding, the short circuited winding gradually takes its place and keeps the total ampere turns on the rotor constant and equal to the ampere turns on the stator. In actual practice, however, the impedance volts are not exactly the same for all rotor positions, but the inequalities are very much less than if the short circuited winding were omitted.

Polyphase Regulators

The windings of polyphase regulators are located on the cores in a manner similar to those of induction motors, there being one stator winding, with one rotor winding corresponding to it, per phase. As in the single-phase design, the shunt or rotor winding is connected across the line and the series or stator winding is connected in series with the feeder. The current in each winding is single-phase but the magnetization of the core is produced by the combined action of all the shunt windings. This produces a rotating field instead of an alternating one as in the single-phase regulator.

Owing to this construction the induced stator voltage is constant and does not vary from zero to normal with the revolution of the rotor from neutral to maximum, as is the case in the single-phase design.

The feeder voltage variation is obtained in the polyphase regulator by varying the angular displacement between the stator and rotor voltages by revolving the rotor.

The polyphase regulator rotor does not contain any short circuited winding, as each stator winding always has a shunt winding in inductive relation to it regardless of the position of the rotor.

Figure No. 3 illustrates a polyphase regulator connected to a feeder. AB is the bus voltage, $A'B'$ the regu-

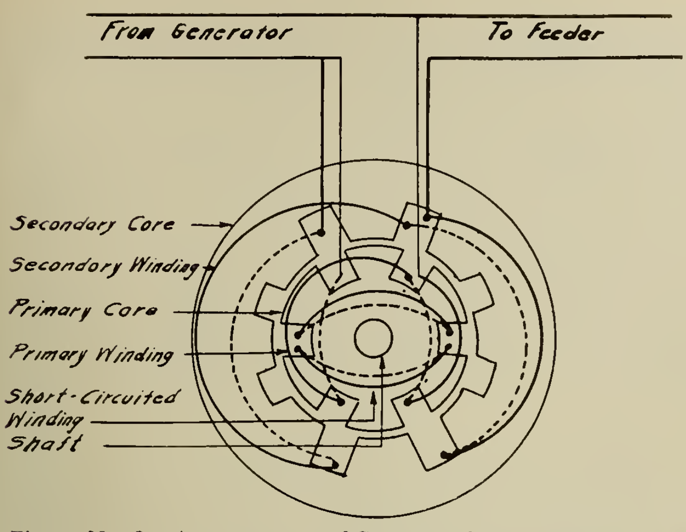

Figure No. 2.—Arrangement of Stator and Rotor Cores and Windings of a Single-Phase Regulator—Rotor in Maximum Lowering Position.

lated voltage, considering one-phase. AA', BB' and CC' are the secondary induced voltages in each phase.

Insulation

Particular care should be taken in the matter of insulating the coils both to ground and between conductors. This involves careful design and choice of material and high quality in these materials. In order to obtain an economical design, the insulation must not be of greater thickness than actually required and yet must be of such a quality that it will stand up when subjected to the strains imposed upon it in the extremely hard service required of regulators. The stator winding of a regulator is connected in series with the line, and any surges, short circuits, etc., which occur on the line usually pass through this winding. Unless the insulation is of high quality it is liable to break to ground or else between turns. In a properly balanced design the likelihood of an internal breakdown is no greater than the likelihood of a breakdown to ground.

In the case of regulators built by the company with which the author is connected, the amount of insulation to ground is such that it has an instantaneous factor of safety of approximately ten when referred to the line voltage. An equalization of the internal and external insulation generally means that the internal factor of safety is much greater, and in some cases it is several hundred, when compared with the normal voltage between turns and layers. The layer insulation in the coils is horn fibre or parchment paper coated with shellac in the slot portion and varnished cambric in the end portions. The slot portion of the coil is placed in special heated moulds and pressed to size. The shellac with which the layer insulation is coated thoroughly impregnates the interior of the coil, so that, when cooled, this part of the coil is as hard and firm as a solid piece of insulation. The end portions of the coils are not moulded, as a certain amount of flexibility is required here when inserting the coils in the slots of the core. After moulding, the coil is adequately insulated with varnished cambric and cotton tape. This type of insulation has been used for years.

Cooling

The chief limiting feature in determining the kilovolt-ampere capacity which can be obtained from a regulator of a given mechanical size is the ability to dissipate the heat generated in the windings. This transfer of heat from the copper to the outside of the machine depends on the cross-section of the winding, the insulation on the conductor, the insulation between the conductors, outside coil insulation, relative amount of coil in slot, coil spacing and cooling medium.

All regulators are either self-cooled or artificially cooled, the self-cooled type being either oil immersed or simply air cooled. Artificial cooling is either by forced air or by water cooling.

When a regulator is carrying load, the maximum temperature exists at the centre of the part of the coil embedded in the core. The heat from this part of the copper is transferred through the coil insulation to the core and also to the end portion of the coil. It should be noted here that the transfer of heat from one material to another is opposed at the junction of the materials, as well as through the body of each material. This is due to imperfect contacts at the junction.

We will consider the case of an oil-immersed self-cooled regulator. The heat from the core and end portions of the coils moves to the oil and from the oil to the tank and from there to the air. This is fairly well illustrated in figure No. 4, which shows the temperature gradients from the copper to the cooling medium of an average sized oil-immersed self-cooled low voltage regulator in a cast iron tank and also a large oil-immersed water-cooled high voltage regulator. The temperature relations represent conditions in a horizontal plane half way up the tank.

The best surface for dissipating heat to the air is a flat dull black surface, and usually in electrical apparatus such as regulators the radiation loss and the convection loss are about in the ratio of one to two. A great deal can be done to secure efficient cooling by properly designing the details of the tank.

The curves, figure No. 4, show that an increase in the thickness of the coil insulation results in a very considerable increase in the temperature drop through it and partially explains the greatly increased cost for machines for the higher voltages.

Self-cooled regulators not immersed in oil are built only in small sizes, because of the difficulty of obtaining sufficient air circulation around and between the windings. Based on volume, air has a heat storage capacity about one twenty-fifth that of oil, so that to remove the same amount of heat the movement of air must be twenty-five times as fast as if oil was used. Hence, the air passages would have to be so

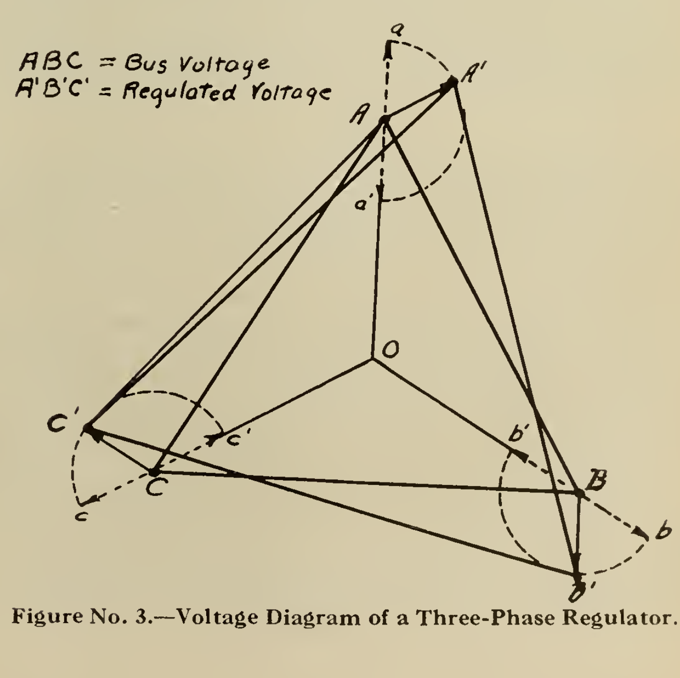

Figure No. 3.—Voltage Diagram of a Three-Phase Regulator.

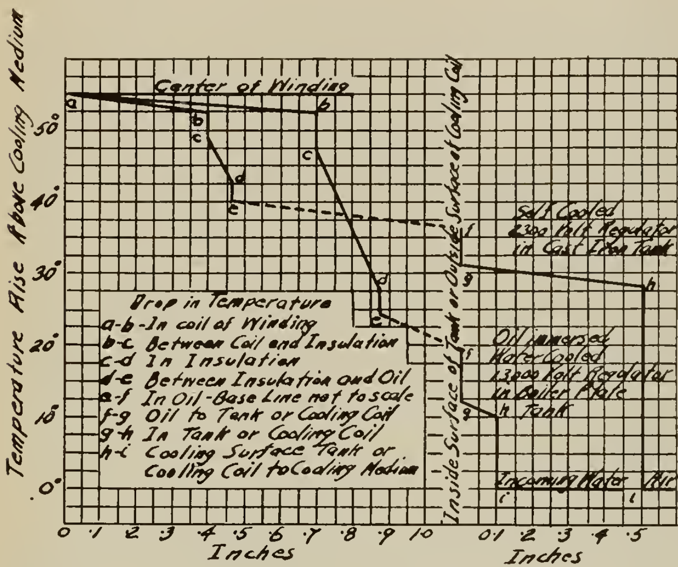

Figure No. 4.—Temperature Gradient Between Centre of Coil Winding and Cooling Medium.

large that the design would become prohibitive in ordinary capacities.

Forced air cooling has been used to some extent, but water cooling has become practically universal where it is necessary to go beyond self-cooling.

Desirable Qualities

Magnetizing Current

With a given line voltage and frequency, the magnetizing current depends upon the flux density, the length of the magnetic circuit and the number of turns in the exciting winding. Increasing the turns would lower the exciting current, but this makes a more difficult winding to build and accordingly the number of turns is kept as low as possible and the other items attended to. The flux density is kept low by making the area threaded by the lines as large as possible and the length of the path is kept as small as possible.

With this in view, the coils are usually wound with 100 per cent pitch and the cores are made high with as small a diameter as practicable. The magnetizing current could also be reduced by decreasing the air gap length, but beyond a certain limit it is not desirable to reduce the gap. A high magnetizing current tends to lower the power factor, and hence the desire to keep this current as low as possible.

Losses

In ordinary regulators, it is more desirable to have a low iron loss than a low copper loss, as the iron loss remains constant for twenty-four hours per day, whereas the copper loss probably is below full load value for the greater part of the day.

A long core of small diameter is more efficient than a short core of large diameter. With the former, equal area of magnetic path may be provided and therefore equal flux densities and the length of copper is less on account of the shorter span, thereby decreasing the copper loss. The weight of core is greater for the larger diameter and the core loss also greater.

The winding losses are due to the I^2R loss and to the eddy currents, which are local currents induced in the windings by the leakage flux. The eddy loss in windings takes place in the part of the copper embedded in the slots and depends on the cross-sectional area of the conductor, its proportions, disposition in slot and frequency of current. In a polyphase regulator, the nearer the ratio of width to thickness of the conductor approaches unity the lower the eddy loss; also, of course, the smaller the area of each strand, the lower this loss. Consequently, from an eddy loss standpoint it is best to use a conductor made up of many strands of small wires, but this has the disadvantage of requiring more space, so that each case has to be judged on its merits. These eddy losses can be measured by means of a wattmeter and deducting the I^2R loss.

The losses in a regulator appear in the form of heat, and the temperature attained by the machine depends on the radiating surfaces, the amount of insulation on the coils and on the cooling medium. The object aimed at is to keep the various parts at a sufficiently low temperature to prevent injury.

In figure No. 1 is shown a drawing of typical single-phase regulator punchings. The slots in the rotor are of approximately the same size and they all contain windings, about half being used for the main rotor winding and the remainder for the short-circuited winding. In the stator core, only about half the slots are used for windings, the others being left vacant to serve as ventilating ducts as well as to provide a uniform and symmetrical air gap as the rotor revolves. These vacant slots are not made as deep as the main slots, and this very appreciably reduces the core loss, especially in the neutral position.

In single-phase regulators, the average of the core loss throughout the range of regulation logically should be used as the basis for efficiency calculations, as the regulator is as likely to operate in one position as another, but for convenience the loss in the maximum position is used and guarantees based on that value. In this position, the core loss is greater than in any position nearer the neutral.

The core loss in a polyphase regulator is considerably higher than in the single-phase design, because, in addition to loss due to the cycle of magnetization and demagnetization of the core, there is the increase in hysteresis and eddy loss due to the rotating flux.

The core loss is kept to a minimum by the use of very thin laminations, (usually 0.014 inch), by insulating the laminations from one another and by the use of the highest grade of material. Great care is also taken to keep the dies for making the punchings sharp and in good condition to eliminate burrs at the edges which would bridge over the laminations.

Ratings Obtainable

Regulators can be built for any voltage and any current for which it is practicable to build generators or motors of corresponding sizes. They have been built for voltages up to 15,000 and for currents up to 10,000 amperes.

The limitations in the building of small regulators for high voltages are the mechanical difficulties of winding the shunt coils with wire sufficiently small to conform with the electrical requirements and the difficulties of providing proper insulation in the small space. The limitations imposed by high current requirements are the making of suitable connections and the bringing of the series leads out of the machine.

In many cases, the above extreme conditions in the regulator may be avoided by the use of auxiliary transformers. These can be used to step down the current or voltage required in the line to suitable values for the regulator.

Regarding the percentage of buck or boost obtainable, this may be had up to 100 per cent, unless in some extreme cases where a design may be limited for the mechanical reasons mentioned above.

Most of our standard single-phase regulators are so arranged that the series winding may be connected in either series or parallel, thus adding to the usefulness of the regulator in many cases. The same arrangement could be used on three-phase regulators but for the fact of having to bring out so many series leads. To provide for a series parallel connection to be made outside of the tank would require the bringing out of twelve leads.

The primary or shunt winding of single-phase regulators may be arranged in some cases for a series parallel connection by bringing out four leads. Regarding the primary of three-phase regulators, it is generally impossible to bring out the twelve leads necessary for a series parallel connection, but in most cases a Y-delta connection can be used as only six leads are necessary for it.

Selection

Suppose we have a feeder leading from a substation and having a regulator connected near the point where it leaves the building. Assume that the regulator has the usual accessories for automatic operation and is connected to regulate the feeder through a potential transformer and contact-making voltmeter. By proper adjustment, the voltage can be held constant at the point where the potential transformer is connected to the line.

At points further out on the feeder, it can be seen that the voltage would not be constant but would vary due to the line drop as the load changed. To overcome this, it is necessary to install a line drop compensator which is operated from one or more current transformers. In order to obtain the proper setting for the line drop compensator, what is termed a " centre of distribution " should be chosen; that, is some point out on the feeder where it is desirable to maintain constant voltage. Ordinary feeders are tapped at various points, and a certain amount of compromise must be made in choosing the centre of distribution.

In order to determine the amount of regulation required, it is usually necessary to take a considerable number of voltage readings on each feeder.

Standard regulators are 10 per cent buck and 10 per cent boost, but in some cases other ratios are desirable. Practically any desired ratio can be arranged for in design, but standard ratings should be used wherever possible.

Three 10 per cent single-phase regulators, connected delta and used to control a three-phase system, are capable of giving 15 per cent buck or boost on the system. If 10 per cent regulation is required in this case, then 7½ per cent regulators could be used. On the other hand, three 10 per cent single-phase regulators connected *Y* will produce 10 per cent buck or boost in the voltage between lines. Three-phase regulators rated 10 per cent boost or buck are so designed as to raise or lower the feeder voltage 10 per cent.

The application of regulators to single-phase feeders does not present any particular difficulty. With regard to polyphase feeders, much more consideration is required in order to obtain the necessary results in the most economical manner.

On a balanced three-phase feeder, good results can be obtained by one three-phase regulator, two single-phase regulators or three single-phase regulators. If the feeder is unbalanced, correct results can be obtained only by the use of three single-phase regulators.

The regulation obtainable on a three-phase circuit depends on line resistance and reactance, unbalance of current, power factor of load, phase rotation and what phases are to be regulated. As the number of factors involved is large, the solution of the problem is somewhat complex and accordingly it is not proposed to go into details here. The conclusion reached is that for a three-phase feeder carrying an unbalanced load, not requiring extremely accurate regulation of all phases, two single-phase regulators could be used to advantage. This has the advantage also that, at a later date, a third regulator may be added if more perfect regulation is required.

On a three-phase four-wire circuit, it is usual to use three single-phase regulators connected between neutral and line. In this way, on a 4,000-volt system, standard 2,300-volt regulators may be used.

In the General Electric Review of March 1918, an example has been taken and worked out. The example and results are as follows:—A three-phase three-wire line with unbalanced current to the extent of 15 per cent and having a resistance and reactance of 1.21 ohms and 1.61 ohms per conductor, respectively, is taken. Using one three-phase regulator, one of the phases may be given perfect regulation, another will be 1.2 per cent above and the third 6 per cent below normal. Using two single-phase regulators, perfect regulation may be obtained on two phases and the third phase will differ 2.2 per cent from normal under favorable conditions. The use of three single-phase regulators gives perfect regulation on all phases, regardless of phase rotation. In the same article,* a set of curves is given showing the regulation which may be expected under various conditions of unbalance, which should be of considerable assistance to anyone desiring to investigate further.

Injurious Operating Conditions

The stator or series winding of a feeder regulator really forms a connection between the bus and the line, and accordingly may be subjected to high voltage, high frequency or high current or a combination of these.

Excessive potentials in feeder lines might be due to conditions internal to the circuit such as short circuits, arcing grounds, operation of circuit breakers, phasing in generators or the occurrence of resonance. External to the circuit, excessive potential may be caused by lightning discharges which are usually of exceedingly high frequencies, probably up to 1,000,000 cycles per second.

Underground feeders are subject only to disturbances originating in the system, while overhead lines may be affected by these and also disturbances originating externally to the circuit.

Feeders which are combinations of overhead and underground lines in addition to the above may develop a trouble on their own account, namely, high voltage due to resonance, and indeed experience has shown that this combination is more sensitive to disturbances than either type of feeder separately.

Overhead feeders may be protected from lightning to some extent by ground wires carried above the lines on the tops of the poles. As a protection against lightning and surges of various kinds, it is now general practice to connect lightning arresters to the bus of the distributing station. It is also sometimes necessary to install arresters and choke coils on each feeder on the line side of the regulator.

On many feeders subject to short circuits it is necessary to employ some special means of limiting the current in cases where it is liable to cause damage to apparatus. Now that the kilovolt-ampere capacity of distributing stations is becoming so large, this is especially the case. Any apparatus connected in series with a feeder is obviously more liable to injury than apparatus connected across the line. Devices in series usually are an oil switch, current transformer, regulator and occasionally a reactor. Of these, the

* Voltage Regulation of Three-Phase Feeders. M. Unger, General Electric Review, March 1918.

induction regulator is most liable to damage as it is a slot wound machine. It is impracticable to design regulators with the same factor of safety which can easily be applied to the other devices above mentioned. It is much cheaper to provide current limiting reactors to limit the short circuit current to reasonably safe values. It is general practice to put the upper instantaneous limit at twenty to twenty-five times normal current, and regulators are built to withstand this.

Induction regulators are ordinarily designed with a magnetizing current of approximately 25 per cent of the full load current. That is, with normal voltage and frequency applied to either winding, (and the other winding open), about 25 per cent of full load current will flow. As the excitation of the regulator the smaller is the effective value of the core in limiting the exciting current. Under short circuit conditions, full line voltage may be considered as being applied to the secondary winding, which is ten times normal secondary voltage for a 10 per cent regulator, and the short circuit current may be considered the exciting current. Under this extreme voltage, the impedance of the regulator is considerably less than normal. For calculations, this is usually taken as one per cent when referred to the feeder voltage, or about one-half of the percentage at normal current.

Applications

Induction regulators are most commonly used on feeders from substations supplying lighting and, in some cases, power. The advantages of their use for this service are generally understood and appreciated by the power companies and their customers. Also, there are various other locations where regulators may be used to advantage in single lines supplying power to buses or transformers.

Some manufacturing processes require accurate voltage control, occasionally over a wide range. Under this heading, there would be included electric furnaces of various types, electric welding and heating and electrochemical and electrolytic processes.

The induction regulator is ideal for the control of high potential tests, as the voltage may be gradually varied from zero to maximum. For laboratory and general testing work, they are also extensively used in the smaller sizes, usually air-cooled hand-operated.

At one time, induction regulators were fairly extensively used for controlling the voltage of synchronous converters. In most cases of late, synchronous boosters have been used as the cost is usually in their favour.

The induction regulator has been used successfully for adjusting the power factor between interconnected systems. A regulator in series with the line joining the systems can cause the lagging or magnetizing current to be supplied by either system by adjusting the voltage on the line at the regulator. By this means, either of the systems can operate at any desired power factor. This change in voltage by the regulator does not produce any change in the power supplied by either system, as its action is identical with the effect produced by changing the excitation of one of two a.c. generators operating in parallel. As no satisfactory contact-making power factor indicator has yet been developed, it is necessary to use motor-operated regulators controlled by hand for this service.

The operation of induction regulators on feeders in parallel and in networks offers some difficulties. Mechanical connection of regulators under these conditions is satisfactory, but is necessarily limited in scope. Various schemes and connections have been worked out for interconnecting electrically the controls of the regulators, but no one system, to include all variations required in general operation, has yet been devised and proved in practice, although a promising system is at present under consideration.

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The Manufacture of Ball and Roller Bearings

Details of the Major Manufacturing Operations in the Production of Ball or Roller Bearings

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It is not possible to go exhaustively into the subject of ball and roller bearings in a short paper, so that the following comments will be confined to only the major manufacturing operations.

The operations are predicated largely upon several elements, the most important of which are metallurgical research, mechanical tests and service of finished bearings, the application in which the bearings are to be used and the constant striving for improvement in quality, the practical application of which must be so formulated as to permit of maximum efficiency of production. The metallurgical questions, (which are quite extensive), will not be dealt with in this paper, except to say that in order for the manufacturing department to function properly it is extremely important that the laboratory determine the best steel for the purpose and then to make sure that the steel manufacturer supplies it to that specification. The steel used varies in analysis for the different requirements, but in general it may be considered as having a content of 1 per cent carbon and 1½ per cent chrome.

When it is considered that there is a very small area of contact between the ball or roller and the raceways, it follows that the unit pressures are very high and are usually in excess of 200,000 pounds per square inch. In order to satisfactorily maintain, over long periods of service, loads of such magnitude, it will be understood that the impurities and mechanical defects in the steel must be held to the absolute minimum.

From an anti-friction engineering viewpoint, there is an unlimited number of combinations of conditions to be met, ranging from small bearings ¾ inch in diameter and having ⅛ inch balls and rotating at 20,000 r.p.m. and upward to the large bearings about 3 feet in diameter and having 3 inch balls or rollers and sustaining many tons of loads and rotating at rather slow speeds. This will give some idea as to the range of sizes of manufacture. In order to meet the different conditions as outlined, it is very important that extremely small tolerances on practically all dimensions be adhered to. This requires very carefully worked out gauges and measuring instruments, as only a few degrees change in temperature will produce scrap rather than usable parts. It follows that a very rigid inspection control must be maintained, as every part must have 100 per cent inspection on every dimension.

The methods of manufacture are constantly changing, and the following describes in general the present methods employed. There are at the present time a number of experiments in process which indicate marked improvement in the way of greater accuracy and higher efficiency over some of the methods mentioned in this paper.

Types of Ball and Roller Bearings

The upper row of bearings in figure No. 1 are known as radial bearings and the lower row as thrust bearings. The radial bearings take loads either at right angles to or parallel with the shaft as well as angular loads. The single row and double row deep groove ball bearings may be considered as the rigid type, whereas the self-aligning ball bearing and self-aligning roller bearing give greater flexibility in that the balls or rollers and inner rings can swivel with the shaft to any position to compensate for shaft misalignment or permanent deflection. This is accomplished by having the raceways in the outer rings spherical. Where end thrust loads are encountered which are in excess of the thrust capacity of the radial bearings, then a thrust bearing is used. This type of bearing takes only endwise load, or one which is parallel with the axis of the shaft and bearing.

For the purpose of this paper, the manufacturing operations on the deep groove single row ball bearing will be considered. These operations follow very closely, and in most cases are identical with, those required on the other types of radial and thrust bearings. When a bearing is spoken of, it is meant to include the inner ring, a set of balls or rollers, a cage or retainer and the outer ring. While the operations change somewhat with the different ranges of sizes of bearings, the manufacturing operations as applying to a bearing which is about 4 inches in outside diameter, 2 inches in bore and having a ball diameter of 11/16 inch will be considered.

Initial Forming Methods of Steel Balls

The manufacture of steel balls may be according to three initial forming methods. Figure No. 2 shows the oper-

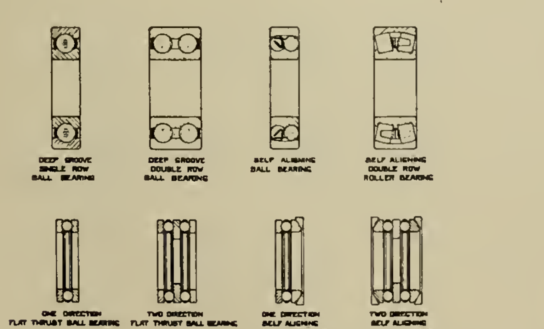

Figure No. 1.—Types of Ball and Roller Bearings.

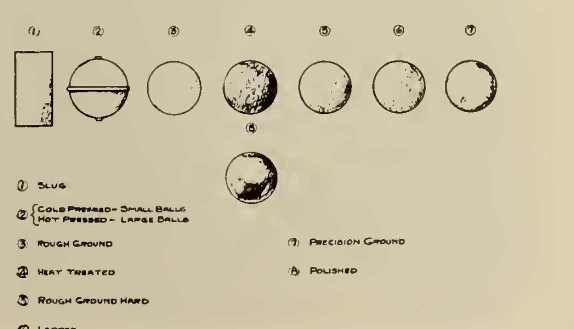

Figure No. 2.—Chart of Operations.

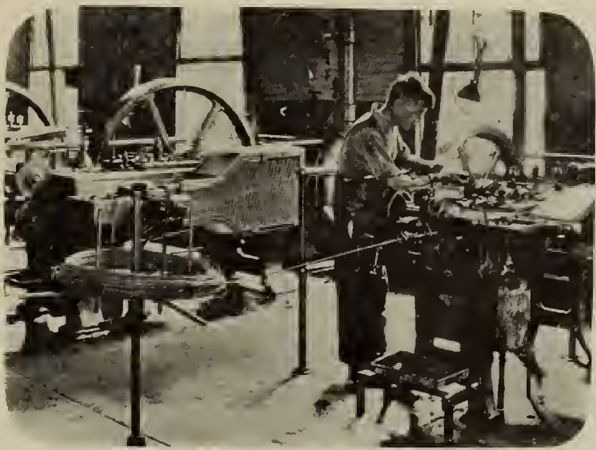

Figure No. 3.—Type of Machine Used in Cold Pressing Method.

ations for either cold or hot pressing, while figure No. 3 shows the type of machine used in the cold pressing method. It will be noted that the wire is fed from a reel into the machine. Two fingers grip the end of the wire while a shear blade cuts off the slug, which is then carried between the dies. Half of the die is stationary while the other half slides on a head operated by a crankshaft. As soon as the halves of the dies come in contact with the slug the fingers recede and the pressing operation is completed by the dies coming together. This machine is entirely automatic and there is sufficient stock left on the ball so that the subsequent grinding operations will remove all possible surface defects.

In the hot pressing method, as shown in figure No. 4, a similar slug, as in cold pressing, is cut off in a regular shearing machine. The slugs are then placed in a hopper and automatically fed through a heating furnace at slow speed. The slugs are ejected at the rear end of the furnace and carried down a metal chute to the operator, who places the heated slug between the dies.

The third method for forming the ball is by forging. A heated bar is placed between the dies in the forging machine and the balls formed in a string. The upper part or hammer portion of the dies oscillates at a very high rate of speed. After the balls are formed they are placed between dies in a regular punch press and cut apart while the metal is still hot.

Figure No. 4.—Type of Machine Used in Hot Pressing Method.

Rough Grinding of Balls

After the operation of forming the balls, they are annealed and then placed in rough grinding machines which remove all of the coarser outside surface. This operation leaves the balls with a very clean surface, although showing coarse grinding marks running in all directions over the surface. Another method of rough grinding by the use of a double head grinder is shown in figures Nos. 5 and 6, while the principle is illustrated in figure No. 7.

No doubt many of you at some time have formed balls of putty between your hands. The action in the accompanying illustration is the same except that it is mechanically controlled. It will be noted that the balls are placed in a ball groove which is stationary and is concentric with the drive or carrier ring which rotates in a direction opposite to the abrasive wheel. The wheel is mounted eccentrically with the centre of the V-groove and the drive ring. It will be noted, therefore, that as the abrasive wheel rotates the balls are also rotating in the groove and are driven by the drive ring. As the abrasive wheel rotates it travels a distance across the balls equal to the face of the abrasive wheel, which is twice the amount of eccentricity between

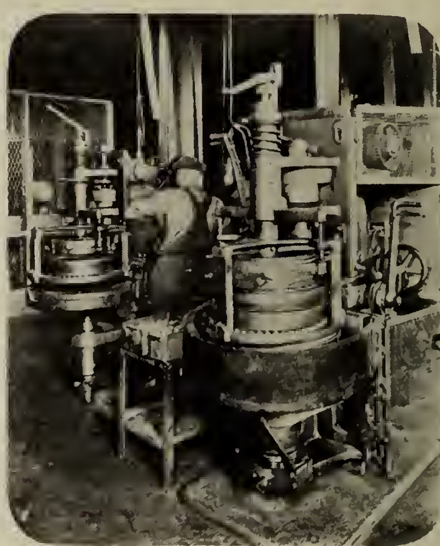

Figure No. 5.—Rough Grinding with Double Head Grinder.

the centres of the shafts. This provides a spinning action of the ball in all directions, thereby bringing every point of the surface uniformly in contact with the abrasive wheel.

Hardening

The type of furnace used for hardening the balls is shown in figure No. 8. It will be noted that the operator is shoveling balls in the open or cold end of the furnace. These balls are picked up through the rotation of the drum by helical grooves which have a very short pitch, and therefore feed the balls through the furnace slowly to the heated end. The requirement here is that the balls remain in a specified heat of about 1,500° for a stated period, depending upon the size of the ball. The balls are discharged at the opposite end of the furnace into a tank of water over which the furnace is mounted. As the balls strike the water there is a very sudden dissipation of the heat, causing the ball to become very hard; at the same time, stresses are set up which, if not relieved, may cause the ball to crack. This relief is afforded by what is known as the drawing operation, wherein the balls are allowed to soak in oil, heated to about 350° F., for a certain period of time.

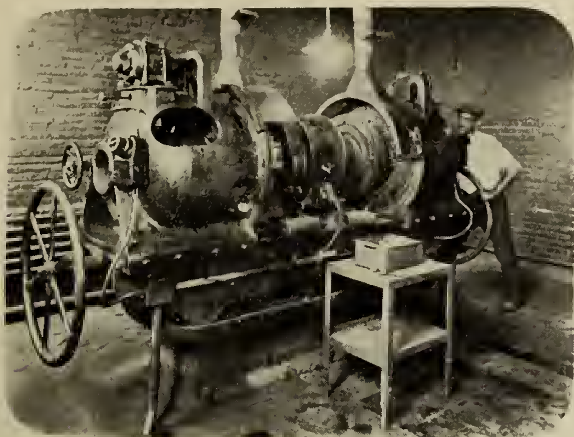

Figure No. 6.—Rough Grinding with Double Head Grinder.

Figure No. 8.—Type of Furnace for Hardening Balls.

Rough Hard Grinding or Lapping

Figure No. 9 shows what is known as the rough hard grinding operation. In this machine there are two cast iron plates on the faces of which are cut a number of concentric grooves, the upper plate being stationary and the lower plate rotating. This operation may be known better as lapping, and is done by the use of an abrasive material mixed with oil.

The lapping operation is illustrated diagrammatically in figure No. 10. In order to obtain uniform accuracy in this operation, it will be noted that the upper or stationary plate has a section cut out which permits the balls to pass from the grooves over a dam into a mixing chamber, so that the balls are being continually changed from one groove to the other, which provides greater lapping uniformity.

Final Grinding

The type of machine on which the final grinding is done is shown in figure No. 11. Here the balls are carried in concentric grooves between an abrasive wheel and a cast iron plate. The abrasive wheel is composed of very fine grains so that the grinding operation is extremely slow and requires on an average of about forty-eight hours. In this operation there is removed about 0.0003 to 0.0004 inch from the surface of each ball. Here again the number of grooves and the constant mixing of the balls from one groove to the other insures extreme accuracy. In this operation, as large a quantity of balls as possible are ground, and to this end a hopper is provided, with a conveyor, which holds about 250 pounds. As the balls are being ground kerosene is injected between the grinding wheel and a cast iron plate, which materially improves the finish of the surface of the ball and at the same time keeps all the particles of steel and abrasive washed out of the machine, as these would otherwise cause scratches on the ball surfaces. As an indication of the accuracy with which this machine performs, all of the balls in each lot will not vary from each other by more than 0.0001 inch and the balls will not vary from the normal size by more than plus or minus 0.00005 inch, and it is within this limit that balls must be used when assembled in the complete bearing.

A diagrammatic view of the finish grinding machine head is given in figure No. 12, indicating the stationary cast iron head and the rotating abrasive wheel, there being a pressure brought upon the balls in the grooves between the two plates of about 7,000 pounds. The mixing hopper is also indicated.

Polishing and Surface Inspection

In the operation of polishing, the balls are placed in steel tumbling barrels and the polishing is accomplished by an extremely fine abrasive known as Vienna lime. This is mixed with water and the whole mass is rotated in the barrels for a period from thirty to fifty-six hours, depending upon ball size. This operation removes about 0.0001 inch from the diameter of the ball. Following this, the balls are placed in wooden tumbling barrels and the balls tumbled in a special grade of very soft leather. This operation does not remove any measureable amount of material, but provides for a very high surface polish.

It is extremely important that every ball be carefully

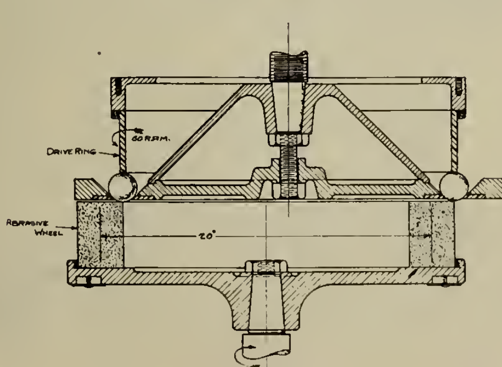

Figure No. 7.—Principle of Rough Grinding with Double Head Grinder.

Figure No. 9.—Type of Machine for Rough Hard Grinding Operation.

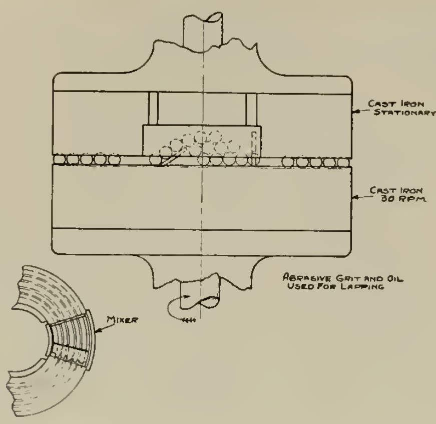

Figure No. 10.—Diagrammatical Illustration of Lapping Operation.

examined for surface defects. Any ball showing even the minutest amount of foreign particles in the steel, or grinding scratches or small flat spots or cracks, is rejected. The inspection is made by placing the balls on a glass plate and a white cardboard is placed under the balls and is used to rotate the balls in all directions. The reflection of the white cardboard on the highly polished surface of the ball tends to magnify any imperfections, which are easily detected. Attention is called also to the fact that the inspectors wear gloves so as to avoid discoloring the surface and subsequent rusting due to handling. Any defective balls are picked out with a magnetic pencil.

Gauging

In the gauging operation, the balls are placed in hoppers and are picked up, one at a time, by a rotating plate at the large end. As the ball approaches the highest point it is dropped into a brass tube which leads down to two hardened knife-edged blades. These blades are set at a slight angle, so that the farther down the incline the ball progresses the wider the opening between the blades. The total variation in the opening from one end of the blade to the other is 0.001 inch. The length of the knife is divided into ten positions, under each point of which there is a tube into which the ball drops and is carried to its proper bin. The variation between these points on the knives is 0.0001 inch. It is almost unbelievable that one may watch these machines in operation for hours and find that the balls drop

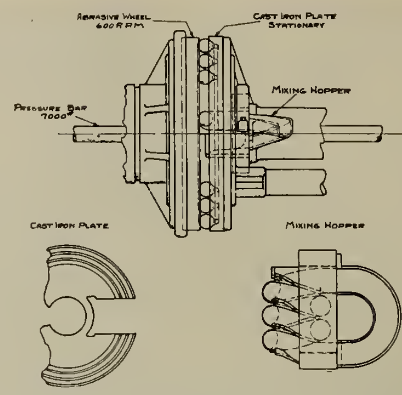

Figure No. 12.—Diagrammatic View of Final Grinding Machine Head.

through at exactly the same point during the entire period. The knife edges must be relapped and reset every two or three hours while the machines are in operation, as the constant dropping of the balls at the same point causes a small amount of wear on the knife edges.

For the larger balls which are too heavy to handle in the method previously shown, each ball is individually gauged in an instrument known as a minimeter. The minimeter is so designed as to greatly multiply the actual amount being measured on the ball so that through a magnifying glass on the indicating dial 0.00005 inch will appear as approximately 1/16 inch. This is an extremely accurate instrument, and the measurement is taken by rotating the ball between the anvil and indicating point so that not only the size is determined but also the accuracy of sphericity. In this inspection the balls are constantly kept in oil. To the side of the operator is shown a set of Johansson gauge blocks. These are the most accurate blocks made and require some four years to complete in order to permit of long periods of seasoning between the lapping operations on the flat surfaces. These blocks are used as masters, and are considered as standard for the setting of all gauges in all operations in the manufacture of the balls and also the bearing rings.

Forming of Bearing Rings

The manufacture of the inner and outer rings may be by one of two methods. Figure No. 13 shows the forging machine method. In this the bars are heated to about 1,900° F. and for about 18 or 20 inches on one end. The rings are formed on the bar by upsetting and then punched off, as shown in figures Nos. 14 and 15.

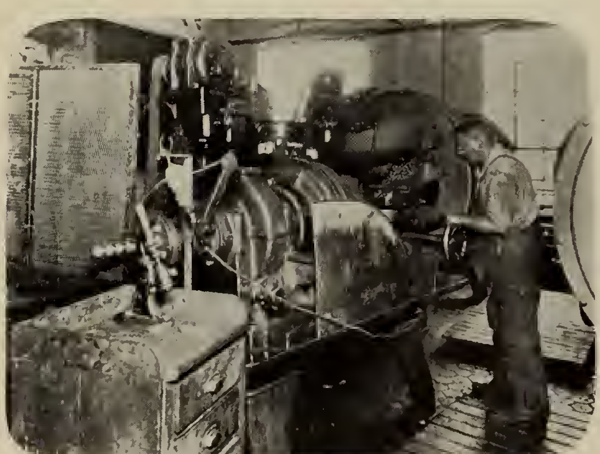

Figure No. 11.—Type of Machine Used for Final Grinding.

Figure No. 13.—Forging Machine Used in Forming Bearing Rings.

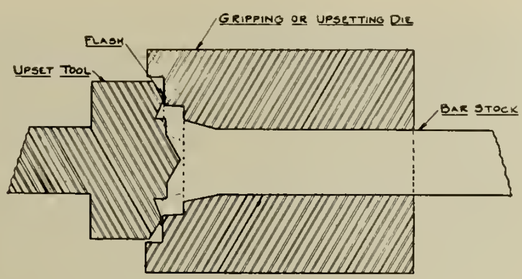

Figure No. 14.—Upsetting Operation.

In the diagrammatic view of the upsetting operation, shown in figure No. 14, it will be noted that the hot end of the bar is held in a gripping die, the bar projecting beyond the front of the die by an amount equal to the volume of material in the ring. The upsetting tool advances and forms an upset or enlarged end on the bar. The small excess amount of metal is allowed to outside the die, forming a flash, which will be in a position perpendicular to the bar.

Figure No. 15 shows the second forging operation, which is accomplished in the upper deck of the same die. In this it will be noted that the bar is no longer gripped in the die, but has clearance so that it is free to slide back when the punching tool comes in contact with the upset portion. As the ring being made is pushed back in the die the flash which was set up in the upsetting operation is sheared off. The ring then travels back until it comes against the shearing blade, and as the punch advances it may be said that the bar is pushed out from the hole in the ring. On the return stroke of the machine, the halves of the dies are automatically open, which allows the ring to drop out.

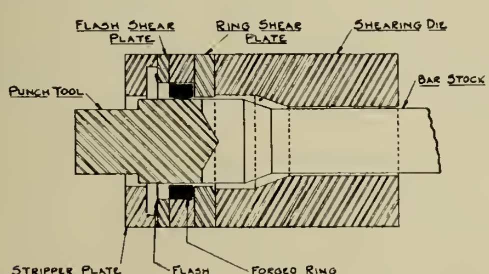

Figure No. 15.—Shearing Operation.

Annealing Bearing Rings

As the forged rings are allowed to cool in air, they become very hard, so much so that it is necessary to anneal the rings before they can be machined. In the annealing operation the doors of the furnace are closed and all joints filled with clay so as to provide as great a reducing temperature inside the furnaces as possible, which will eliminate a certain amount of decarbonization or scaling of the surface of the rings. These furnaces are brought slowly up to a heat of about 1,600° F. and given a period of soaking at this constant temperature. The fires are then shut off so that the furnace is allowed to cool very slowly. The annealing operation takes about four days, and the rings subsequently show a Brinell hardness of from 160 to 180, which is the proper hardness range for efficient machining. The annealing operation also provides for proper rearrangement of the crystals of the material so that a more uniform structure may be effected in the subsequent hardening operation.

Machining Bearing Rings

The forged rings are then turned on turret lathes. The ring is held in a three-jaw chuck which is operated by air pressure, and the tools are held in the turret so that they may be swung around into position in proper sequence.

Figure No. 16 shows the first and second operations for the inner ring machining in the turret lathe, the dark portions indicating the metal which is removed from the rough forging. The first and second operations for outer ring machining is shown in figure No. 17.

The second method for making machined rings, which is used principally for the small and part of the medium range of bearing sizes, is done on an automatic four-spindle lathe. In this machine, four bars of steel are inserted from the rear of the turret head. These bars are automatically fed up to stops and the tools are fed toward the spindle head. Thus, there are four sets of tools working on four different bars at the same time. For each quarter turn of the spindle head there is delivered one inner and one outer ring. This type of equipment is extremely efficient.

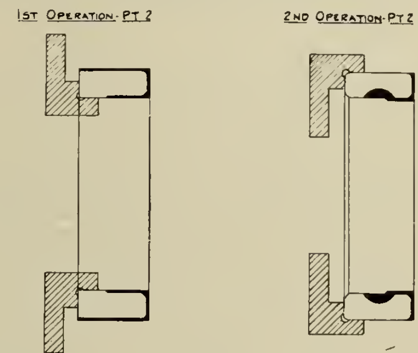

Figure No. 16.—Turret Lathe First and Second Operations for Inner Ring Machining.

The operations on the four different spindles are illustrated in figure No. 18. In the first spindle, the hole forming the bore of the inner ring is drilled and the outside diameter of the outer ring is turned. In the second spindle, the trepanning operation takes place, which is removing the metal between the two rings. In this operation, the sides of the outer ring are faced and the outer ring cut off. This leaves the inner ring still part of the bar, as shown in the No. 3 spindle. On this spindle the bore of the inner ring is reamed, the outside diameter of the inner ring is turned to size and the groove is formed by the use of a circular tool. In spindle No. 4 the inner ring is faced on both sides and cut off and a small drill is inserted to give a lead hole for the next operation on the larger drill on spindle No. 1. In spindle No. 4, after the inner ring is cut off the bar is automatically pushed forward to a stop which governs the width of the ring.

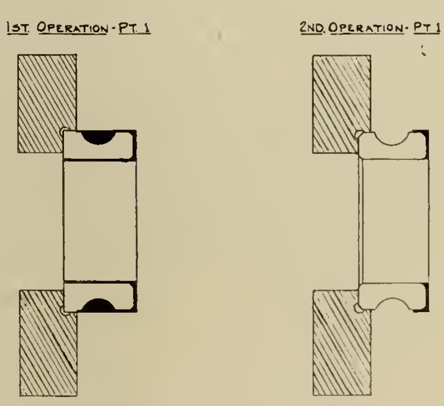

Figure No. 17.—Turret Lathe First and Second Operations for Outer Ring Machining.

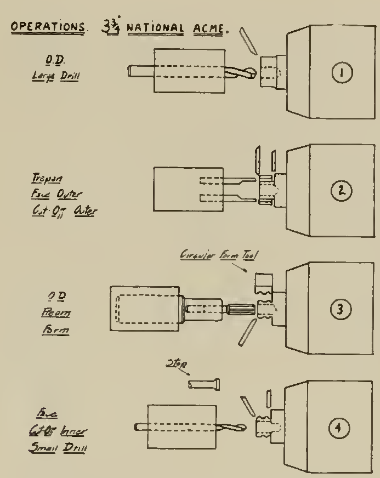

Figure No. 18.—Four Different Spindle Operations.

Ring Hardening

Following the completion of the inner and outer rings, the corners are chamfered or radiused on quick operating speed lathes, following which the numbers, the make of steel used, date of manufacture and company's name are stamped on the sides of the rings. The rings are then ready for hardening. The smaller rings are wired together while the larger rings are placed separately flat on the hardening trays. These furnaces are about 18 feet long and the rings enter the furnace on the cold or pre-heating end. It takes about one hour and fifteen minutes for a tray to go through the furnace, which is sufficient to have brought the rings slowly up to the quenching temperature of about 1,450° F. and also allow them a certain soaking period. The rings are removed on the opposite end of the furnace and dropped into an oil bath. This suddenly quenches the rings, which process constitutes hardening. The rings will show a Brinell hardness from 600 to 650. Following the hardening, the rings are drawn in oil at about 350° F. in order to remove as far as possible the quenching strains which have been set up. Considerable care must be taken in quenching or the rings will go out of shape, thus making the following grinding operations more difficult.

Grinding Bearing Rings

The first operation on the rings after they have been hardened is surface grinding. This is done by placing the rings on a rotating magnetic chuck and a cylindrical wheel is brought down until it contacts with the side of the ring. The rings are then turned over and the other side ground in a similar manner. The maximum tolerance allowed for side grinding is one and a half thousandths on the thickness of the ring, and the sides must be paralled within 0.0005 inch.

The next operation is bore grinding the inner ring. In this the ring is held in the chuck between two flat surfaces clamping the sides of the ring. The operation is to insert the ring between the two surfaces mentioned, the clamping being under very light spring pressure so that the ring can be moved readily when a very light pressure is exerted in the bore. The bore of the ring is then centred with the grinding wheel, after which a heavier clamping pressure is brought upon the ring so that it cannot move readily. The grinding wheel traverses through the bore, and in order to secure the proper finish a certain number of passes are allowed after the feed of the wheel has been thrown off. For a bore of the bearing size mentioned earlier, there is a tolerance of plus zero and minus 0.0004 inch. The proper

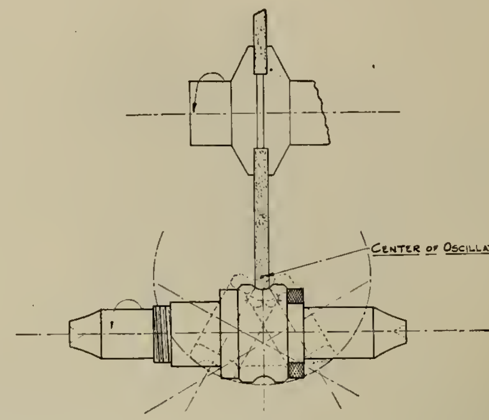

Figure No. 19.—Diagrammatic View of Grinder for Grinding Outer Ring Groove.

bore is indicated by a specially devised constant reading indicating mechanism. This is made up principally of a lever arm of ten to one, the long end of which bears against an indicator so that every one ten-thousandths of an inch is magnified about one hundred times. The point which bears on the bore of the ring must be very hard in order to prevent wear, and a diamond is therefore used for that purpose.

In external grinding operation the outside diameter of the outer rings is ground. The rings are mounted on an arbor held between centres and a large grinding wheel having a peripheral speed of about 6,000 feet per minute is brought in contact with the work and traverses over the entire surface to be ground. The rings on the arbor are centred by a special apparatus which contacts between the arbor and the inside ball groove of the ring. The outside diameter of this ring is held to a tolerance of plus zero and minus 0.006 inch. The operator here is shown using a snap gauge having a go and no-go limit. While this is a very satisfactory method of gauging, there have been developed constant reading indicators for this operation.

Grinding Outer and Inner Ring Grooves

The method used in grinding the grooves in the outer rings is known as oscillating. (Figure No. 19.) It may be said that the groove is generated as the ring is oscillated about a centre which is also the centre of the groove radius. While the ring oscillates about the centre of the groove, the grinding wheel is stationary, except that it is fed into the groove. In this way there is no necessity for trueing the wheel to the proper radius, as that is automatically done by the contact of the wheel and the oscillating ring. The grinding wheel spindles for this operation rotate at about 10,000

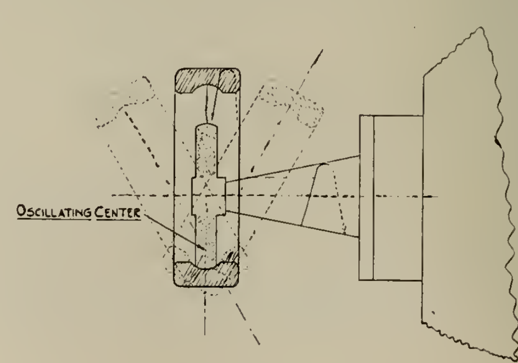

Figure No. 20.—Diagrammatic View of Operation of Grinding for Inner Ring Grooves.

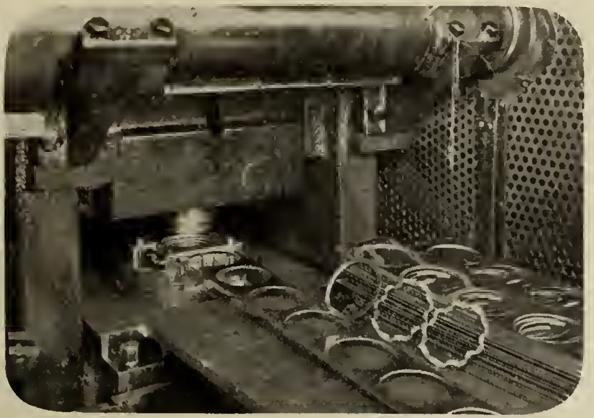

Figure No. 21.—Stamping Machine Used in Making Blanks for Retainer.

Figure No. 22.—Assembly of Bearings.

r.p.m., while the ring is rotated at about 250 r.p.m. and in a direction opposite to that of the rotation of the wheel. Size is controlled by a constant reading indicator.

An oscillating machine of a different type is used for the generation of the grooves in the inner rings. In this case the inner ring is held on an arbor between centres and the work head oscillates about the grinding wheel. Constant reading indicators are also used in this operation.

A diagrammatic view of the operation of grinding the inner ring grooves is shown in figure No. 20. The grooves of both rings are held to a tolerance of about 0.0005 inch. It is also necessary that the grooves be parallel with the sides of the ring so that, in the assembled bearing, what might be termed as a side cam action will be eliminated or held to an extremely small tolerance. All grinding operations are generally divided into rough grinding and finish grinding except in the smaller rings, where the roughing and finishing are done in one operation. There are two reasons for dividing the grinding operations into two parts,—one is that in rough grinding, as the scale on the ring from the hardening operation is taken off, the ring will warp out of shape and a sufficient period should be allowed after rough grinding to permit of what might be termed as air seasoning, so that when the finish grinding operation is completed the amount by which the ring will continue to go out of shape will be minimized or within permissible limits.

It further is necessary that the character of finish be of the highest quality. This is especially true with reference to the finish of the grooves in which the balls roll. The grooves of both rings must have an absolutely true contour and be free of chatter marks, scratches and minute flat spots; otherwise the bearings will be rough running and noisy. This requires that a finer grade and grain of wheel be used for finishing than is advisable for the roughing operation.

Following the finish grinding of the grooves they are brought to a very high polish on specially designed machines for the purpose. The polishing operation must be just as carefully done as the finish grinding, as it is a very easy matter to ruin the accuracy of the finish grinding operation by improper polishing.

The rings are then taken to a sorting machine, in which operation the rings are selected for matching together with the proper diameter of balls. Through the use of this machine it is possible to get any variation of fit from 0.0002 inch tight to 0.0005 inch loose between the raceways and the balls by increments of 0.0001 inch, the amount of internal tightness or looseness depending upon the requirements of the bearing application.

In all bearings the balls or rollers are kept apart by a cage or separator. These are of various types for different purposes. The most usual form, however, is known as the pressed steel cage. Figure No. 21 shows a stamping machine in which are made the blanks for the retainer, the blanks being stamped from cold rolled steel having about 0.20 carbon content. The blank ring is next put into a forming die and formed so that the pockets of the ring will give a clearance on the diameter of about 0.004 inch over the ball diameter. The third operation on the cage is punching the rivet holes. The three cage operations are shown.

Assembly of Bearings

The final machine operation is assembling by putting the balls between the raceways, which is accomplished by what is known as eccentric displacement of the rings. The balls are filled in to the crescent-shaped opening between the rings, the inner ring is moved to a central position with the outer ring and the balls separated equally around the circumference. The two halves of the cage are then put in with the rivets, which are headed in a die in a regular power press.

As mentioned before, all of the individual operations must be very rigidly inspected. The final inspection of the completed bearing includes reinspection for the bore, outside diameter, width, parallelism of the grooves with the sides of the rings, eccentricity of inner ring rotating and of outer ring rotating, the squareness of the bore with the sides of the rings and the squareness of the outside diameter with the sides of the rings, as well as for any surface defects or blemishes. If the bearing gets through this most exacting inspection, then it is thoroughly washed in a specially designed washing machine and is sent to a slushing tank to be covered with hot grease, after which it is wrapped in oil paper and packed in cardboard boxes, the boxes being stamped so as to indicate the size and type of bearing it contains.

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VOLUME X NOVEMBER 1927 No. 11

Annual General Professional Meeting

Montreal, February 14th, 15th, 16th, 1928

The First Plenary Meeting of Council

One of the most important changes in the constitution of The Engineering Institute took place as a result of the report of the Committee on Policy in 1922, when it was recommended that the unit of representation on Council should be the Branch instead of an electoral district. When the change took effect, it became evident that some means would have to be found to enable the Councillors from all parts of the Dominion to attend Council meetings as frequently as possible, in order that they might participate in the actual deliberations of Council. Without this, their activities as Councillors would in many cases be restricted to reading the minutes sent them and expressing their views by correspondence. The Committee on Policy, in fact, suggested that Council meetings should be held from time to time, for which Councillors' expenses should be defrayed by The Institute; and it was thought that such meetings, lasting several days, would give time, not only for the transaction of the routine business of a regular Council meeting, but also for the thorough discussion of important matters of policy involving the future and progress of The Institute.

Such Plenary Meetings of Council cannot be held without considerable outlay, and, while successive Annual General Meetings have given instructions to Council to arrange for a Plenary Meeting, it has not been possible to find the money for doing this until the present year.

The first Plenary meeting of Council, which has just taken place in Montreal on October 10th, 11th and 12th, is therefore a notable event in the history of The Institute. For the first time, Councillors from the majority of our Branches, scattered over the wide extent of country between Cape Breton and Vancouver Island, have personally taken part in the work of a regular Council Meeting.

No less than twenty-nine out of the forty-three members of Council were able to attend, and in the course of their three days' stay in Montreal devoted nearly twenty hours' actual deliberation to the consideration of The Institute's affairs.

A general account of the proceedings will be found in another column of the present issue of the Journal, and members who glance over the record of the work accomplished cannot fail to realize the profound influence which Council meetings of this kind must exert upon the Councillors themselves, and, through them, upon the Branches they represent.

Many of the Councillors present had their first opportunity of observing personally the working of the mechanism which deals with the many matters of important routine handled by Council at each meeting, such, for example, as the examination and classification of applications for admission and transfer; the opening of the ballot for election of candidates; the presentation, scrutiny and approval of the report of the Nominating Committee; and it is believed that Councillors, from their experience at this meeting, will be able to return to their Branches with information obtained from personal experience which will remove many of the misapprehensions and misunderstandings which crop up from time to time regarding these matters.

A number of important recommendations for the amendment of the By-laws were submitted by the Committee on Legislation and By-laws, and were considered, and recommendations were made regarding them for the consideration of the Annual General Meeting.

The problem of Students' Sections in connection with the various Branches was taken up; and a long and profitable discussion took place regarding the various objections and difficulties which have developed from time to time as to the titles and qualifications attached to the various grades of membership in The Institute. Much illuminating discussion also took place on the future of The Institute and its policy, particularly in regard to its relationship with the various Provincial Associations of Professional Engineers.

At the conclusion of the sessions, the members expressed general satisfaction with the very definite advance made towards the solution of a number of these problems, and it was hoped that means would be found to bring before the membership at large, preferably at the next Annual General Meeting, some idea of the benefits accruing to members of Council and to The Institute from such Plenary Meetings.

The Institute's policy of decentralization, commenced in 1919 and developed since that time, has undoubtedly given rise to an efficient Branch organization, but effective co-ordination of Branch activities is sometimes limited by geographical and other hindrances arising from the vast extent of the Dominion and the natural diversity in our members' occupations and points of view.

The influence and prestige of The Institute as a national organization is dependent on our members' adoption of a broad rather than a local outlook, and the interchange of views and ideas is a powerful aid to progress in this direction. No more effective means of developing true solidarity in our membership can be employed than the holding of periodical reunions of our Councillors.

Such meetings as the one just concluded are thus not only advantageous, but are a real necessity if our Branches are to function effectively as component parts of a Dominion-wide organization.

Copies of Recently Issued Transactions Available

As announced in several recent issues of the Journal, a new volume of Transactions of The Institute was issued this year covering a selected number of the more important papers which were published in the Journal during the years 1923, 1924 and 1925.

This volume was distributed to those from whom subscriptions were received prior to its publication. A limited number of extra copies were printed and these are now available, so that any member of The Institute desiring a copy should forward his request to the Secretary at Headquarters in Montreal. The subscription price to these Transactions is three dollars, ($3.00), per copy. The volume contains twelve papers occupying 219 pages, and is illustrated throughout. The papers republished in this volume are as follows:—

The Strength of Steel I-Beams Haunched with Concrete, by H. M. Mackay, M.E.I.C., Peter Gillespie, M.E.I.C., and C. Leluau, M.E.I.C.
The Cost of Hydro-Electric Power, C. V. Christie, A.M.E.I.C.
An Economic Examination of the Hudson Bay Railway Project, W. Nelson Smith, M.E.I.C.
The Hudson Bay Railway, J. L. Busfield, M.E.I.C.
Inductive Co-ordination as a Practical Problem, J. Clarke, A.M.E.I.C.
Steel Rails, C. B. Bronson.
Consideration of Rainfall and Run-off in Connection with Sewer Design in the Montreal District, J. G. Caron, A.M.E.I.C.
British Columbia Dams, E. Davis, M.E.I.C., and E. G. Marriott, A.M.E.I.C.
The Cost of Electric Power, P. T. Davies, M.E.I.C.
The Municipal Underground Conduit System of Montreal, G. E. Templeman, A.M.E.I.C.
Hydraulic Regulating Gates, F. Newell, M.E.I.C.
The New Esquimalt Drydock, J. P. Forde, M.E.I.C.

Nominations for Officers' Ballot

Regulations

Not later than the seventh day of November, the Secretary shall mail to each corporate member of The Institute the officers' ballot, as prepared by the Nominating Committee and the Council.

Additional nominations for the officers' ballot signed by ten or more corporate members and accompanied by written acceptances of those nominated, if received by the Secretary on or before the first day of December, shall be accepted by the Council and shall be placed on the ballot. The words "Special Nomination" shall be printed conspicuously near such names, and the names of the members making such nomination shall be printed on some part of the ballot.

Notices shall be deemed to have been mailed to members as prescribed by the By-laws if such notices are printed in the Journal of The Institute and mailed by the dates prescribed in the By-laws.

Nominations

The report of the Nominating Committee was presented to Council at the meeting held on September twenty-seventh, nineteen hundred and twenty-seven, and subsequently approved by Council at the meeting held on October twelfth, nineteen hundred and twenty-seven. The following is a list of the nominees as prepared by the Nominating Committee and now published for the information of all corporate members, as provided by Sections 69 and 75 of the By-laws:—

PRESIDENT: Julian C. Smith, M.E.I.C., Montreal.

VICE-PRESIDENTS: Zone B*—E. H. Darling, M.E.I.C., Hamilton; A. J. Grant, M.E.I.C., St. Catharines.

Zone C*—W. G. Mitchell, M.E.I.C., Quebec; Ellwood Wilson, M.E.I.C., Grand'Mere.

Zone D*—F. O. Condon, M.E.I.C., Moncton; W. C. Risley, M.E.I.C., Sydney.

COUNCILLORS: *Victoria Branch:* **E. Davis, M.E.I.C., Victoria; W. S. Drewry, A.M.E.I.C., Victoria.

Vancouver Branch: **P. P. Brown, M.E.I.C., Vancouver; W. H. Powell, M.E.I.C., Vancouver.

Calgary Branch: **P. J. Jennings, M.E.I.C., Calgary; J. H. Ross, A.M.E.I.C., Calgary.

Edmonton Branch: **W. J. Cunningham, A.M.E.I.C., Edmonton; R. J. Gibb, M.E.I.C., Edmonton.

Lethbridge Branch: **R. Livingstone, M.E.I.C., Lethbridge; H. R. Miles, M.E.I.C., Lethbridge.

Saskatchewan Branch: **H. R. MacKenzie, A.M.E.I.C., Regina; W. M. Stewart, A.M.E.I.C., Saskatoon.

Winnipeg Branch: **H. A. Dixon, A.M.E.I.C., Winnipeg; James Quail, A.M.E.I.C., Winnipeg.

Lakehead Branch: **R. B. Chandler, M.E.I.C., Port Arthur; G. R. Duncan, A.M.E.I.C., Fort William.

Sault Ste. Marie Branch: **C. H. E. Rounthwaite, A.M.E.I.C., Sault Ste. Marie; J. M. Silliman, A.M.E.I.C., Sudbury.

Border Cities Branch: **A. J. M. Bowman, A.M.E.I.C., Windsor; S. E. McGorman, M.E.I.C., Walkerville.

Niagara Peninsula Branch: **M. B. Atkinson, M.E.I.C., St. Catharines; J. R. Bond, A.M.E.I.C., Niagara Falls; S. R. Frost, A.M.E.I.C., Niagara Falls; J. C. Street, M.E.I.C., Welland.

London Branch: **W. C. Miller, A.M.E.I.C., St. Thomas; W. P. Near, M.E.I.C., London.

Hamilton Branch: **W. F. McLaren, M.E.I.C., Hamilton; A. H. Munson, A.M.E.I.C., Hamilton.

Toronto Branch: ††I. H. Nevitt, M.E.I.C., Toronto; J. G. R. Wainwright, A.M.E.I.C., Toronto.

Kingston Branch: **A. Jackson, A.M.E.I.C., Kingston; L. T. Rutledge, M.E.I.C., Kingston.

Peterborough Branch: **R. L. Dobbin, M.E.I.C., Peterborough; E. R. Shirley, M.E.I.C., Peterborough.

Ottawa Branch: ‡J. D. Craig, M.E.I.C., Ottawa; J. E. N. Cauchon, A.M.E.I.C., Ottawa.

Montreal Branch: †A. S. Dawes, M.E.I.C., Montreal; C. S. Kane, A.M.E.I.C., Montreal; Fraser S. Keith, M.E.I.C., Montreal; J. A. McCrory, M.E.I.C., Montreal.

Quebec Branch: **J. M. H. Cimon, A.M.E.I.C., Quebec; A. B. Normandin, A.M.E.I.C., Quebec.

S. Maurice Valley Branch: **B. Grand Mont, A.M.E.I.C., Three Rivers; F. O. White, M.E.I.C., Three Rivers.

Saguenay Branch: **J. L. Delisle, A.M.E.I.C., Chicoutimi; B. Pelletier, A.M.E.I.C., Chicoutimi.

Moncton Branch: **M. J. Murphy, A.M.E.I.C., Moncton; F. L. West, A.M.E.I.C., Sackville.

Saint John Branch: **W. J. Johnston, A.M.E.I.C., Saint John; J. Stephens, M.E.I.C., Fredericton.

Cape Breton Branch: **W. E. Clarke, M.E.I.C., Sydney; E. L. Martheleur, M.E.I.C., Glace Bay.

Halifax Branch: **H. W. L. Doane, M.E.I.C., Halifax; W. F. McKnight, M.E.I.C., Halifax.

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* One Vice-President to be elected for two years.
† Two Councillors to be elected for three years each.
†† One Councillor to be elected for three years.
‡ One Councillor to be elected for two years.
** One Councillor to be elected for one year.

Plenary Meeting of Council— October 10th, 11th, 12th, 1927

The first Plenary Meeting of Council of The Institute was held on Monday, Tuesday and Wednesday, October 10th, 11th and 12th, 1927, the following members being present:—

President A. R. Decary in the Chair; Vice-Presidents J. H. Hunter, G. D. Macdougall and W. G. Mitchell; Councillors W. C. Adams, J. N. Anderson, R. W. Boyle, K. L. Dawson, R. L. Dobbin, J. T. Farmer, A. L. Ford, B. Grand Mont, L. F. Grant, E. P. Johnson, G. F. Layne, T. R. Loudon, H. R. MacKenzie, G. R. MacLeod, C. M. McKergow, H. W. McKiel, W. F. McLaren, D. L. McLean, W. C. Miller, P. L. Pratley, J. L. Rannie, W. C. Risley, P. M. Sauder, G. Stead and Treasurer F. P. Shearwood.

Letters and telegrams of regret were read from Councillors J. L. Busfield, P. Gillespie, C. H. E. Rounthwaite and E. A. Cleveland.

At the morning session on October 10th, the President briefly welcomed the visiting Councillors and pointed out that in addition to the special business of the meeting, certain items of a routine nature would come up, such as the consideration and classification of applications for admission and transfer; this, one of the most important duties performed by Council, would be new to many of the members present who had not hitherto had an opportunity of taking part in Council meetings.

Representations having been received from various points in the west regarding the date for the Western Professional Meeting, 1928, it was decided to approve the second week in June, as this is the date desired by the Vancouver Branch, which is sponsoring the meeting.

The report of the Finance Committee was submitted, and the financial statement to September 30th, 1927, was approved; the recommendations of the Finance Committee with regard to two special cases were approved and one resignation was accepted.

The report of the Nominating Committee for 1927 was submitted and approved. (This appears elsewhere on page 495.)

In connection with the report of the Nominating Committee, it was suggested that Section 68 of the By-laws should be amended so that the Nominating Committee's list will contain the names of one or more nominees for each office to be filled, (except that of president), instead of two, as is obligatory at present. This suggestion was referred to the Legislation and By-laws Committee for consideration and report.

The report of the Legislation and By-laws Committee was presented regarding the various items referred to it by Council during the past year, and as a result it was decided to recommend the following changes in the By-laws:—

(a) The inclusion of a section specifically authorizing the formation of Students' sections in the various branches of The Institute.

(b) Changes in the wording of Sections 68 to 71 so as to make a distinction between the list of nominees prepared by the Nominating Committee and the voting paper which is sent out to all Corporate Members for their votes, the term "officers' ballot" being at present used to denote both these documents.

(c) An amendment to Section 74, confirming the present practice, according to which subscriptions to the Journal are not required from Honorary Members and Life Members.

A suggestion that it should be the policy of The Institute to relieve from payment of annual fees all members who have retired from active work or have attained a certain age or seniority in The Institute was referred to the Finance Committee for its recommendation.

The following elections and transfers were effected:—

Elections	
Members	5
Associate Members	6
Juniors	2
Students	3

Transfers	
Associate Member to Member	4
Junior to Associate Member	9
Junior to Affiliate	2
Student to Associate Member	15
Student to Junior	11

During the afternoon session on October 10th, Professor Loudon presented verbally a progress report of the committee appointed under his chairmanship in March 1927 to recommend ways and means of strengthening in the estimation of the general public the importance of the engineering profession, and of The Engineering Institute in particular, and generally to stimulate the interest of engineers in the affairs of The Institute.

The committee had considered a number of suggestions, among others, that The Institute should encourage its members to take a greater interest in public affairs, and that there should be formed in The Institute a service bureau for the purpose of educating employers of engineers and of finding employers for a larger number of our young graduates.

Active discussion followed, after which it was resolved to endorse the idea of the promotion of an engineering service bureau and that Professor Loudon's committee be continued and empowered to bring in recommendations for the organization of such a bureau.

In the morning session of Tuesday, October 11th, the question of the formation of Students' sections was taken up, and it was pointed out that there were now in existence two Students' sections, also that the By-laws at present do not contain any specific provisions for their constitution or relations with Branches and Headquarters.

As a result of the discussion which followed, it appeared that in the opinion of Council it would be advisable that these sections should report to the local Branch and not to Headquarters, and that the rules governing them should be given as much flexibility as possible in order that they may be adapted to local conditions.

After considerable further discussion, it was decided to recommend the amendment of Section 53 of the By-laws by the addition of a clause providing that Students' sections may also be established on the request of ten Corporate Members of the Branch.

The next topic considered was the desirability of continuing the present practice of requiring Students to subscribe to the Journal, it being pointed out that they have opportunities of seeing the Journal in their university libraries; the question was ultimately referred to the Finance Committee for consideration and report.

The afternoon session of October 11th was devoted to the consideration of the policy to be pursued as regards The Institute's relations with the various Provincial Associations of Professional Engineers, and it was noted with pleasure that the Councils of several of these bodies had indicated their willingness to discuss the possibility of arriving at uniform examination requirements. It was pointed out that while The Institute's examinations are always in the form of written papers, it has been found necessary by many of the Professional Associations to adopt in addition other means of judging of the qualifications of candidates, as, for example, the preparation of theses or oral examinations.

The action of the Council of the Association of Professional Engineers of British Columbia was particularly appreciated, that Council having given the matter much consideration and having offered to discuss the drawing up of a mutually satisfactory syllabus for written examinations in regard to the branch of civil engineering.

It was pointed out that several of the Professional Associations are now engaged in preparing definite programmes for their examinations, and that the present would seem to be an opportune time for discussion, with a view of making such modifications in the examination syllabus of The Institute as may appear desirable.

After prolonged discussion, it was decided to authorize The Institute's Board of Examiners to undertake negotiations with the Boards of Examiners of the various Professional Associations with a view of arriving at uniformity in the examination requirements of The Engineering Institute and of the various Professional Associations, so far as this is possible, having regard to the constitutions of the bodies concerned.

Attention was drawn to the somewhat heavy financial burden arising in cases where members belong to The Institute and also to one or more professional associations, and several speakers expressed the hope that some arrangement would be possible in the future to lessen this difficulty. This led to a consideration of the general relations between the activities of the various bodies, and, after a long and interesting discussion, it was resolved that a standing committee, representative of all the interested provinces of the Dominion of Canada, be appointed by the Council of The Engineering Institute to study the problems involved in co-ordinating the activities of The Engineering Institute of Canada and the several Associations of Professional Engineers.

The next subject dealt with was the desirability of making any changes in requirements for, and titles of, the present grades of membership in The Institute. Attention was drawn to the difficulties which had arisen in connection with the age limit in the class of Student and Junior, the misunderstanding which is found occasionally as to the meaning of the prefix "Associate" in the title "Associate Member," and the confusion which occurs between the status of Affiliates of The Institute and Affiliates of Branches. Members reported the opinions in regard to this matter which have been expressed at a number of the Branches, and it was decided that the whole question should be referred to a committee with instructions to give most careful consideration to this important matter and make recommendations at a later date. In view of the fact that the deliberations of this committee will take a considerable time, it was decided in the meantime to recommend an amendment to the By-laws permitting Council, at its discretion, to waive the age limits of 27 for the grade of Student and 33 for the grade of Junior in cases where, in Council's opinion, such action is desirable.

At the evening session of October 11th the Chairman of the Finance Committee drew attention to the necessity of additional financial resources for The Institute, and it was pointed out that with the present income a number of desirable activities could not be provided for, among which might be mentioned:—

The building up of a reserve or endowment fund, as suggested by Past-President Walkem.

Financial assistance for Branch secretaries, giving them some office help and thus rendering possible, for example, local development of our employment and information services.

More revenue for Branches, enabling them to undertake activities and give facilities to members which are now out of the question in most Branches.

Payment of expenses of speakers, lecturers and papers for smaller and more isolated Branches.

Payment of expenses of all Councillors attending one or more Council meetings annually, thus making the Plenary Meeting of Council an annual event.

Publication of Transactions. The scheme of calling on members to purchase Transactions has not proved very satisfactory.

Financial and other assistance to Students' sections.

Purchase of books for the library and further development of information service at Headquarters.

Further development of employment service.

Attention was also drawn to the fact that many Branches find it necessary to levy Branch fees, and that some Branches complain that the present scale of rebates is unsatisfactory.

The consensus of opinion of Council appeared to be that the most satisfactory way of raising additional income at the present time would be to increase the subscription of Members by $5.00 per annum, thus, for instance, making the annual fee of a Montreal Branch resident, (including the Journal subscription), $21.00, as compared with $16.00 as at present, and that of all other Branch Members $18.00 instead of $13.00 as at present.

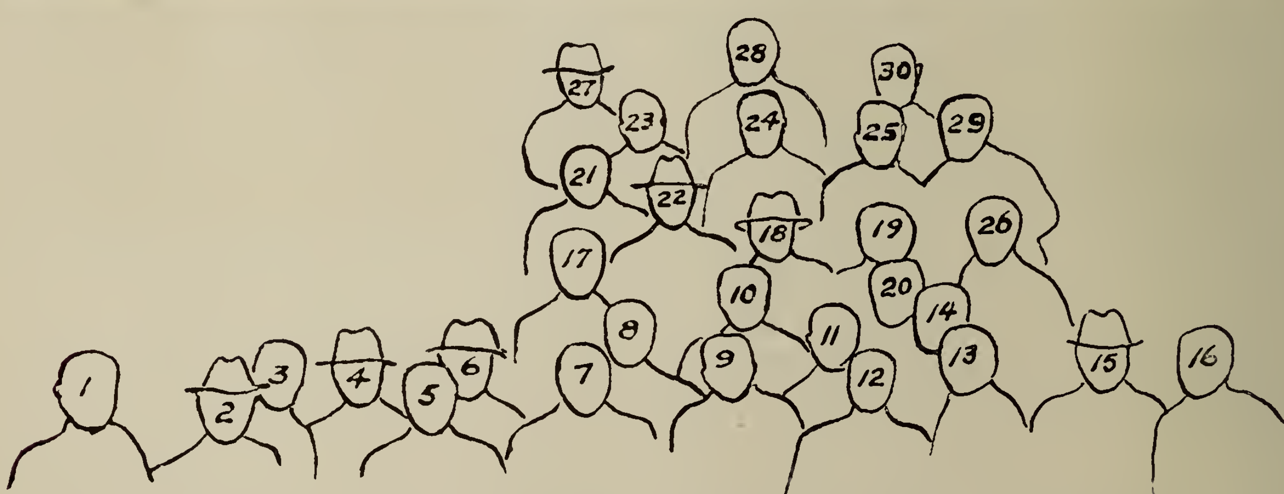
It was accordingly decided to recommend an amendment to Section 35 of the By-laws embodying this change.

Discussion followed as to what extent and in what manner The Institute should endeavour to guide public opinion by making declarations on questions of public policy. As a result, it appeared to be the sense of Council that while papers regarding public questions could quite properly be presented before our Branches, and their discussion would be advantageous as placing the technical arguments of both sides before The Institute and the public, no resolutions endorsing or condemning any policy should be taken or published unless the question is a purely local one. It was felt that The Institute as a body, when pronouncing upon questions of public policy, would too frequently be misunderstood by the public.

The first topic taken up at the morning session of October 12th was that of Engineering Education. It was pointed out that The Institute has taken an active interest in this matter for years, important discussions having taken place on the subject during the Annual Meetings in Montreal in 1925 and in Quebec in 1927. A committee had been appointed in 1922 to secure the adoption of more definite engineering degrees, and a committee on the apprenticeship and training of engineers had presented a valuable report in February 1925. The subject had been discussed at numerous Branch meetings, and there is now a Committee on Engineering Education, which, under the chairmanship of Mr. F. B. Brown, holds itself ready to co-operate with the Society for the Promotion of Engineering Education.

The discussion brought out the fact that in Canada the present trend in engineering education is to lay greater stress on the basic subjects, such as physics and mathematics, rather than to develop highly specialized courses.

After expressions of opinion by a large number of



Plenary Meeting of Council at Institute Headquarters, Montreal, October 10th, 11th and 12th, 1927.

1—R. J. Durley, M.E.I.C., General Secretary; 2—B. Grand Mont., A.M.E.I.C., Councillor, St. Maurice Valley Branch; 3—F. P. Shearwood, M.E.I.C., Treasurer; 4—W. G. Mitchell, M.E.I.C., Vice-President, Zone C; 5—T. R. Loudon, M.E.I.C., Councillor, Toronto Branch; 6—W. C. Miller, A.M.E.I.C., Councillor, London Branch; 7—J. H. Hunter, M.E.I.C., Vice-President, Zone C; 8—E. P. Johnson, A.M.E.I.C., Councillor, Niagara Peninsula Branch; 9—Dr. A. R. Decary, M.E.I.C., President; 10—W. F. McLaren, M.E.I.C., Councillor, Hamilton Branch; 11—H. W. McKiel, M.E.I.C., Councillor, Moncton Branch; 12—W. C. Risley, M.E.I.C., Councillor, Cape Breton Branch; 13—G. Stead, M.E.I.C., Councillor, Saint John Branch; 14—G. R. MacLeod, M.E.I.C., Councillor, Montreal Branch; 15—G. D. MacDougall, M.E.I.C., Vice-President, Zone D; 16—N. E. D. Sheppard, A.M.E.I.C., Assistant Secretary; 17—J. T. Farmer, M.E.I.C., Councillor, Montreal Branch; 18—P. L. Pratley, M.E.I.C., Councillor, Montreal Branch; 19—K. L. Dawson, A.M.E.I.C., Councillor, Halifax Branch; 20—P. M. Sauder, M.E.I.C., Councillor, Lethbridge Branch; 21—J. N. Anderson, A.M.E.I.C., Councillor, Victoria Branch; 22—L. F. Grant, A.M.E.I.C., Councillor, Kingston Branch; 23—R. L. Dobbin, M.E.I.C., Councillor, Peterborough Branch; 24—D. L. McLean, A.M.E.I.C., Councillor, Winnipeg Branch; 25—J. L. Rannie, M.E.I.C., Councillor, Ottawa Branch; 26—G. F. Layne, A.M.E.I.C., Councillor, Saguenay Branch; 27—R. W. Boyle, M.E.I.C., Councillor, Edmonton Branch; 28—W. C. Adams, M.E.I.C., Councillor, Montreal Branch; 29—A. L. Ford, M.E.I.C., Councillor, Calgary Branch; 30—H. R. MacKenzie, M.E.I.C., Councillor, Saskatchewan Branch.

members present, the Secretary was directed to inform the Chairman of the Committee on Engineering Education of The Institute, and the deans of the various engineering schools, as to the views advanced at this meeting.

In regard to the question of future Plenary Meetings of Council, all present expressed their appreciation of the benefits to be derived from such meetings, but in view of the expense involved it was decided to refer the question of holding future Plenary Meetings to the next Annual General Meeting.

Further discussions dealt with the desirability of having a Plenary Meeting of Secretaries of Branches, provided that funds can be made available; the desirability of holding an Annual Meeting of The Institute in the west in the near future; and the desirability of amending the procedure in connection with the ballot of Council on applications for election and transfer.

At the close of the meeting, the President thanked Council for the manner in which the business had been carried out, and was presented by the members of Council present with a fountain pen as a memento of a very successful assembly.

OBITUARIES

Robert Todd Locke, M.E.I.C.

It is with regret that we record the death of Robert Todd Locke, M.E.I.C., which occurred in Brazil on April 7th, 1927.

The late Mr. Locke was born at Lockeport, N.S., on March 23rd, 1866, and graduated with the degree of B.A. at Dalhousie University in 1885. Following graduation he was employed in the provincial engineer's office, Nova Scotia, and later as levelman on surveys for the Halifax and Northeastern Railway and also for the Inverness and Richmond Railway. In June 1888 he was appointed first assistant to Nova Scotia Central Railway in charge of the Lunenburg to La Have river division. In January 1890 he was employed by the Nova Scotia government in charge of railway surveys from Lockeport to Barrington and Windsor Junction to Hubbard's Cove.

In the latter part of 1890, Mr. Locke went to Brazil, and, upon arrival in that country, he was placed in charge of location for the Rio de Janeiro and Northern Railway, and the following year he was engaged as first divisional engineer on location for the Taubato and Amparo Railway, later being appointed engineer in chief of the same work. In 1893 he entered private practice at Jaboticabal, state of Sao Paulo, where he was engaged on various surveys, railway location and general exploration, the latter being principally in connection with the development of power.

During the last fifteen years, Mr. Locke organized two railway companies, the first shortly before the war was abandoned and the second, the Sao Paulo Oeste Railway, of which he was managing director, was completed and is at present successfully operating. He devoted a great deal of his time to the welfare of the town in which he had settled, taking a very active part in its development.

Mr. Locke was an extraordinarily active man, and throughout his career had been engaged on many hazardous expeditions, his escape from which can be attributed only to his physical condition, his coolness and his courage. Mr. Locked joined The Institute in its early days as the Canadian Society of Civil Engineers, when he was elected a Student on May 3rd, 1887; he was transferred to Associate Member on November 19th, 1890, and to Member on October 8th, 1903.

Charles Henry Rust, M.E.I.C.

In the death of Charles Henry Rust, M.E.I.C., which occurred at his home in Toronto on September 22nd, 1927, The Institute has lost one of its past-presidents and a staunch supporter, whose name has appeared on its membership roll since the inception of the Canadian Society of Civil Engineers in 1887. Serving successively as councillor, vice-president and president, he was prominent in the affairs of The Institute throughout his active career. His kindly and affectionate disposition endeared him to all those who were privileged to know him intimately. His mature judgment, unfailing courtesy and tactful manner fitted him for the numerous high positions which he held in the engineering profession and made him loved and respected by his many business associates.

The late Mr. Rust was born at Great Waltham, Essex, England, on December 25th, 1852. He was educated at Brentwood Grammar School in the same county, and in 1872 came with his family to Canada. Soon after his arrival in Canada he accepted a position on the engineering staff which was then engaged on a preliminary survey of

CHARLES HENRY RUST, M.E.I.C.

the Ontario and Quebec Railway. Five years later he entered the services of the city of Toronto when he was appointed rodman on the engineering staff under the late Frank Shanly, who was then city engineer.

In 1881, Mr. Rust was appointed to the office of assistant engineer by Redmand J. Brough, then city engineer and manager of water works, and in 1883 he was made assistant engineer in charge of sewers, which position he occupied until 1891. During this period he held also the office of principal assistant engineer, and in the spring of 1892, after the resignation of Granville C. Cunningham, who had been acting city engineer, Mr. Rust was appointed acting city engineer until the appointment of the new city engineer, E. H. Keating, in July of the same year. This led to his immediate appointment as deputy city engineer, holding this office until February 1898, when, upon the resignation of Mr. Keating, he was appointed city engineer and manager of the water works.

In 1912, Mr. Rust resigned the position of city engineer of Toronto to accept the position of city engineer of the city of Victoria, B.C., being attracted by the mild climate and the prospect of the pending installation of a new municipal water supply from Sooke lake. While in Victoria, he was requested by the government to report, in conjunction with Mr. R. H. Thompson, upon the Greater Vancouver sewerage scheme. He also reported for the municipality of Coquitlam upon the Second Narrows bridge, near Vancouver. Six years later he returned to Toronto and became connected with the Toronto Street Railway and Toronto Electric Light Company until these were taken over by the Toronto Hydro-Electric System, and he was identified with this latter organization until his death.

The first survey estimates and plans for the main drainage works of the city of Toronto were made while Mr. Rust was in charge of the sewer department, and his proposed scheme was reported upon by Messrs. Hering and Grey. At later dates, other surveys, reports and estimates for the same scheme were made and were reviewed by various prominent engineers. Because of his knowledge of the requirements of the city in regard to sewerage and sewage disposal, he was instructed by the city council to proceed to England on two occasions to make investigations into the most modern methods then in use. His reports were reviewed by Strachan of London and Watson of Birmingham, England. It was not until 1908 that these works were commenced, and they were completed a few years later within the estimated cost.

Under his administration and direction, many improvements were made in the municipal water system, notably the construction of a water supply tunnel excavated in rock beneath the waters of the harbour and extending to a new intake in lake Ontario. This was supplemented in 1908 by a modern slow sand filtration plant of a capacity sufficient to meet the full requirements of the city at that time.

During his tenure of office as city engineer of Toronto he was called upon, in addition to his routine work, to make reports on a great variety of engineering matters. These included, among others, the preparation of preliminary plans and estimates of cost for a municipal lighting plant, a municipal telephone plant and the furnishing of the city with electric power from Niagara falls. He was also vested with certain arbitrary powers through an agreement between the city of Toronto and the Toronto Railway Company, and the good work which he was able to accomplish in this connection was due very largely to his unfailing patience and diplomacy.

His services were frequently in demand as a consultant and expert among the municipalities near Toronto, but his onerous duties occupied so much of his time that he was obliged to refuse many urgent invitations. He found time, however, to report on a scheme of sewerage for the city of Kitchener, Ontario, and acted as one of the arbitrators on the purchase of the Belleville, Lindsay and Ingersoll water works.

The late Mr. Rust was one of the first members of the Canadian Society of Civil Engineers, now The Engineering Institute of Canada, having been elected a Member on February 3rd, 1887. He served as councillor on the Council of The Institute during the years 1899, 1900, 1905 and 1907, as vice-president in 1901 and 1910, and was elected president in 1911.

He was elected a member of the American Society of Civil Engineers in 1899 and served as vice-president during the years 1913-1914. In 1902, he was elected president of the American Society of Municipal Improvements. He was also a member of the executive committee of the American Water Works Association. For many years he was a member of the National Club of Toronto and the Royal Canadian Yacht Club.

Richard Birdsall Rogers, M.E.I.C.

Death has claimed one of The Institute's first members and one of the best known and respected citizens of Peterborough, Ont., in the person of Richard Birdsall Rogers, M.E.I.C., who died at his home near Peterborough on October 2nd, 1927.

Practically a life long resident of Peterborough, he was born there on January 16th, 1857, and received his early education at the Old Union School of that city, later attending Trinity College School at Port Hope, and, entering McGill University in 1872, he graduated in 1878 in civil and mechanical engineering with the degree of B.A.Sc. For five years following graduation he practised civil engineering, being engineer for the townships of Caron and Otonobee, and in 1883 he was appointed superintending engineer for the federal government on the Trent canal works, which position he held until 1905, when other activities claimed his personal attention. He was instrumental in the adoption of the hydraulic lift lock on the Trent canal at Peterborough and Kirkfield, Ont., having made the suggestion to the then minister of railways and canals in the year 1895. The idea impressed the department, and Mr. Rogers was commissioned to go to Europe and ascertain the facts and methods regarding the construction of two such locks. He left Canada in February of 1896 and inspected the lock at LaFontinette, in southern France, and at LaLouvinere, in Belgium. and at Norwich, England. Upon his return to Canada, he was instructed by the department to prepare plans for the letting of contracts for the construction. The Peterborough lock was officially opened on July 9th, 1904, and the Kirkfield lock some two years later. During his engagement as superintending engineer of the Trent canal he had the supervision of many other important works of construction. Upon his retirement from the federal service in 1905, his interest was centred around the Northumberland Power and Paper Company developments. Later, he retired from active professional work and devoted a great deal of his time to farming.

RICHARD BIRDSALL ROGERS, M.E.I.C.

As a citizen of Peterborough, Mr. Rogers took a prominent part in furthering local activities. In the early days he took a great interest in sports, and was himself a member of the Dominion championship four-oared crew. Of late years he was active in the direction of improvement in the district in which he resided. During the war he was chairman of a recruiting committee which materially aided that work in his district. He was a member of an organization formed in Ontario and Quebec with the object of fostering a better feeling between the two provinces and devoted considerable time and effort to the project with good results. He founded the first branch of the Farmers' Clubs in 1918, and was elected president for a number of years.

Mr. Rogers' membership in The Institute dates from the year 1887, having been elected a Member on May 12th of that year. His active interest in The Institute, (then the Canadian Society of Civil Engineers), led to his election as councillor for four years, 1901-04 inclusive. He was also a member of the Institution of Civil Engineers of London, England, and was commissioned a Dominion Land Surveyor and a Provincial Land Surveyor.

Major Arthur d'Odet d'Orsonnens, A.M.E.I.C.

Deep regret is expressed in recording the death of Major Arthur d'Odet d'Orsonnens, A.M.E.I.C., which occurred at his home in Ottawa, Ont., on September 23rd, 1927.

The late Major d'Orsonnens was born at Montreal, Que., on May 31st, 1865, and received his early education in Montreal, later attending a course for militia officers at the Royal Military College, Kingston, Ont. From 1882-1883 he was apprentice under the late Joseph Rielle, M.E.I.C., Provincial Land Surveyor, and later assistant to the late Raoul Rinfret, M.E.I.C., civil engineer and Dominion Land Surveyor at Dawson, Yukon Territory. In 1902 he was appointed to the staff of the Yukon Surveys Branch of the Department of the Interior at Dawson, as draughtsman, and was transferred to Ottawa in 1905, when he took charge of the Yukon work in the same department. On March 1st, 1906, he left this department, being appointed district staff adjutant at Quebec, where he was engaged in connection with various military works. In 1908 he returned to Ottawa and rejoined the Topographical Surveys Branch, where he remained until the time of his death. He was employed first in this department as a draughtsman, but during the last eight years he made a specialty of constructing relief models of various areas of Canada.. These relief maps were designed to show graphically the features of the country, the exhibit of which at the Central Canada Exhibition at Ottawa has been an outstanding feature for several years past. He was quite prominent in military affairs for a number of years, serving through the North West Rebellion and as adjutant at the Royal School of Infantry at St. Johns, and later being second in command of the garrison at Quebec city.

The late Major d'Orsonnens joined The Institute as Associate Member on December 21st, 1915.

Bethlehem Steel Export Corporation, Bethlehem, Pa., has issued a new catalogue descriptive of the Bethlehem Pulverizers, which in twenty-two pages describes and illustrates this type of equipment and gives details of its operation. This publication is known as catalogue J and may be secured from the head office of the company or from any of its district offices.

Combustion Engineering Corporation, Limited, has issued a catalogue entitled "C. E. Fin Furnace," which is known as FF-2. The booklet describes this type of furnace and is well illustrated with diagrams of installations under various conditions.

Link-Belt Limited has recently issued an announcement to the effect that they have acquired the factory and plant of the Elmira Machinery and Transmission Company, Limited, at Elmira, Ont., and that they have completed their new plant in Toronto, which is located at Eastern avenue and Leslie street.

PERSONALS

F. H. Job, Jr.E.I.C., has resigned his position with the Blaw Knox Company, Blawknox, Pa., and has joined the staff of the Hamilton Bridge Works Company, Limited, Hamilton, Ont.

L. B. Stewart, S.E.I.C., who since graduating from McGill University with the degree of B.Sc. this year has been located at Victoriaville, Que., has joined the staff of the Electric Service Corporation, Shawinigan Falls, Que.

W. E. Wright, S.E.I.C., is located at Madawask, Me., with the Management Engineering and Development Company of Dayton, Ohio. Mr. Wright graduated from Queen's University in civil engineering in 1926.

J. J. Crawford, S.E.I.C., has accepted a position with the Canadian Cellulose Company at Cornwall, Ont. Mr. Crawford is a graduate of the University of Toronto of the year 1922. Until accepting his present position, he was chemist with Messrs. Price Brothers and Company, Limited, at Kenogami, Que.

D. C. Macpherson, S.E.I.C., who has been with the Dominion Bridge Company, Limited, at Quebec, on the erection of the Limoilou mills, has been transferred to Ottawa on the erection staff of the Chateau Laurier hotel. Mr. Macpherson graduated from Queen's University with the degree of B.Sc. in 1924.

H. R. Bissell, Jr.E.I.C., has returned from Bisbee, Arizona, where he was on staff of the Phelps Dodge Corporation, to take the position of mine superintendent at the Tetreault mine of The British Metal Corporation, (Canada), Limited, Montauban, Portneuf county, Quebec. Mr. Bissell graduated from McGill University with the degrees of B.Sc. and M.Sc. in mining in 1922 and 1923 respectively.

W. Chase Thomson, M.E.I.C., who for the past two years has occupied the position of bridge and structural engineer of the Canadian section of the Joint Board of Engineers engaged in the study of the St. Lawrence river waterways project, has completed his engagement and has been appointed to the engineering staff of the Dominion Bridge Company, Limited, Montreal. Prior to his appointment with the Federal Department of Railways and Canals, Mr. Thomson was engaged in consulting work in Montreal.

C. H. Timm, A.M.E.I.C., is at present on the staff of the Dominion Bridge Company, Limited, on the erection of the Montreal South Shore bridge. Mr. Timm was formerly sales engineer with the Northern Foundry Company of Sault Ste. Marie, Ont. During the erection of the Quebec bridge he was on the staff of the St. Lawrence Bridge Company. Subsequently, he was assistant to the plant engineer of the Dominion Bridge Company and later chief draughtsman of the mechanical superintendent's department of the same company

George Coutts, A.M.E.I.C., is with the Department of Railways and Canals as field engineer on the Hudson Bay terminal work, having resigned his position of assistant engineer on the Trent canal at Peterborough at the end of March last. During the intervening months prior to his present appointment he was resident engineer on provincial highway work at Melita, Man. Mr. Coutts is a graduate of Glasgow University, from which he received the degree of B.Sc. in 1912. He served overseas with distinction with the Canadian Engineers and Royal Engineers from 1915 until the end of the war, and was mentioned in despatches and awarded the Military Cross.

A. W. Sinnamon, M.E.I.C., has resigned his position as mechanical engineer of The Hubbell and Benes Company, Cleveland, Ohio, to become works manager of Van Dorn Iron Works Company of the same city. Mr. Sinnamon was born in Ireland, and, upon coming to Canada in 1901, was first employed in the mechanical department of the Dominion Iron and Steel Company, Limited, at Sydney, N.S., following which he was appointed chief engineer of the Canada Foundry Company, Limited, Toronto, Ont. In 1913 he was engaged in private practice in Ottawa, after which he was for six months chief engineer of the Anniston Ordinance Company, Alabama, returning to Montreal to accept the position of mechanical superintendent of Armstrong-Whitworth and Company of Canada, Limited. From 1917-18 he was manager of the Joliette Steel Company, Joliette, Que., and later was engaged in organizing Terrebonne Electric Power and Steel Company to develop hydro-electric power at Terrebonne, Que. In 1919 he was appointed assistant chief engineer with the Algoma Steel Corporation, Limited, Sault Ste. Marie, Ont.

J. L. Morris, M.E.I.C., Receives Degree of Doctor of Engineering

J. L. Morris, M.E.I.C., civil engineer and land surveyor of Pembroke, Ont., was the recipient of the degree of Doctor of Engineering conferred upon him by the University of Toronto at the recent convocation upon the occasion of the centenary celebrations. Dr. Morris graduated from the School of Practical Science, University of Toronto, in the year 1881 and received the degree of C.E. in the same university in 1885. He has had extensive experience in construction and various allied branches of engineering. As early as 1886 he entered private practice, and carried out many important works throughout Ontario. For a number of years he was town engineer of Pembroke, Ont., and at the present time is the senior member of the firm of Morris and Moore, surveyors and engineers, with headquarters at Pembroke, Ont.

D. M. Bright, A.M.E.I.C., Enters Private Practice

D. M. Bright, A.M.E.I.C., who for some time past has been mechanical engineer for the Chicago Automatic Electric Boiler Company, has returned to Canada and has opened an office in London, Ont., where he will engage in private practice, specializing in power plant equipment, heating problems, electric steam generators, etc.

Mr. Bright is a native of Ireland and came to Canada in 1912, when he was resident mechanical engineer for the Middle West Boving Company of Canada, Lindsay, Ont. The following year he joined the Canadian British Engineering Company at Winnipeg, Man., as designing and superintending engineer. From 1914-19 he served overseas with the Canadian Engineers, and was appointed staff captain in charge of design and layout of workshops and on tests for light railways and aerial ropeways, etc. Prior to going to Chicago, he was mechanical engineer with the Manitoba Power Commission, engaged on design and layout of mechanical equipment of power plants in the province of Manitoba.

T. H. Hogg, M.E.I.C., Receives Degree of Doctor of Engineering

T. H. Hogg, M.E.I.C., chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, received the Honorary Degree of Doctor of Engineering at the convocation of the University of Toronto on October 7th, 1927.

Dr. Hogg is a graduate of the year 1907 of the University of Toronto, from which he received the degrees of B.A.Sc. and C.E. Prior to and immediately following his graduation he occupied various offices with the Ontario Power Company at Niagara Falls. In 1911 he became editor of Canadian Engineer and in 1912 was appointed assistant hydraulic engineer with the Hydro-Electric Power Commission of Ontario, subsequently being made acting hydraulic engineer and later chief hydraulic engineer for the Commission.

T. H. HOGG, M.E.I.C.

M. Barry Watson, A.M.E.I.C., Enters Private Practice

M. Barry Watson, A.M.E.I.C., has resigned from the position of director of the department of engineering in the Central Technical School, Toronto, to engage in consulting engineering practice with Harry H. Angus, B.A.Sc., specializing in power plants, lighting, heating and ventilation, etc., with offices at 2 Bloor street west, Toronto, Ont.

Mr. Watson received the following degrees from the University of Toronto: B.A.Sc. in 1910, C.E. in 1916 and M.E. in 1918. During the summer months of his university course he was engaged on railway, municipal power systems

M. BARRY WATSON, A.M.E.I.C.

and installation work. From May 1911 to October 1912 he was resident engineer for Messrs. Chipman and Power in charge of design and installations of water works and sewerage systems in various western towns. The following year he was appointed assistant mechanical engineer of the Toronto Power Company, and later assistant engineer of the Ontario Department of Public Highways. From 1914-17 he was lieutenant with the Royal Engineers, engaged on various military engineering works in connection with bridges, excavations, roads and water supply in both England and France. He was also for a time aviator and flight commander, Royal Air Force, employed as chief instructor in aeroplane design, etc., in the School of Aeronautics.

Alex. Gray, M.E.I.C., Appointed Chief Engineer and Manager, Saint John Harbour Commission

Alex. Gray, M.E.I.C., engineer in charge of Saint John harbour for the Federal Department of Public Works, has been appointed chief engineer and manager of the Saint John Harbour Commission, according to an announcement made by the chairman of the Saint John Board of Harbour Commissioners, his appointment being effective from November 1st. The announcement of Mr. Gray's appointment accompanies a statement of the plans for the further development of the harbour, and in his appointment the commission has retained the services of one who has had a great deal of experience, particularly in connection with the development of this harbour.

ALEX. GRAY, M.E.I.C.

Mr. Gray was born at Fearn, Ross-shire, Scotland, in 1881. He received his early education at the public school and Royal Academy, Tain, Scotland, and for seven years attended the evening classes at the Heriot-Watt Technical College, Edinburgh, and Dundee University. In 1896 he was engaged with Ordnance Survey of Scotland, remaining on this work until 1901, when he spent one year in the city engineer's office, Dundee, Scotland. The following year he was engaged on mine development work in the Gold Coast in West Africa in the capacity of assistant engineer, remaining in that country until March of 1905 in various engineering positions. In 1905 he came to Canada, and was appointed assistant engineer with the Dominion Coal Company, Glace Bay, N.S., where he was in charge of erection of mine buildings and was also engaged on railway construction. For five years, from April 1906, he was with the Grand Trunk Railway, occupying successively the positions of assistant resident engineer and resident engineer of maintenance, the latter position being in connection with the Ottawa division. In July 1911 he was appointed assistant engineer in charge of the Ottawa river storage for the Public Works Department.

Mr. Gray served on the Council of The Institute during the years 1919, 1920 and 1921.

A. C. Tagge, M.E.I.C., Appointed President of Canada Cement Company, Limited

A. C. Tagge, M.E.I.C., vice-president and assistant general manager of the Canada Cement Company, Limited, is now president of the company, according to an announcement issued recently. He has occupied the position of assistant general manager of the company since 1917.

Mr. Tagge was born at Ann Arbor, Mich., in 1870, and received his early education in the public schools of Ann Arbor and his technical education at Michigan University, from which he received the degree of B.Sc. in 1897. In 1898 he was draughtsman with the Link-Belt Machinery Company at Chicago, Ill., and two years later was employed by the Osborne Engineering Company, Cleveland, Ohio. In 1901 he was appointed erecting engineer and superintendent of the Peninsular Portland Cement Company, resigning this position in 1902 to come to Canada as engineer with the International Portland Cement Company at Ottawa. He remained with this company until 1905, when he occupied a similar position with the Western Canada Cement and Coal Company. Two years later he returned to Ottawa as engineer and superintendent of the International Portland Cement Company, until he accepted the position as general superintendent with the Canada Cement Company at Montreal in the year 1909. He occupied this position until 1919, when he was promoted to assistant general manager of the company.

A. C. TAGGE, M.E.I.C.

Mr. Tagge has always taken an active interest in the affairs of The Institute, and last year was chairman of The Institute's Nominating Committee.

ELECTIONS AND TRANSFERS

At the meeting of Council held on October 10th, 1927, the following elections and transfers were effected:—

Members

ADAMS, Philip Ernest, B.Sc., (Vermont University), designing engineer, Can. Bridge Co., Ltd., Walkerville, Ont.

KEARNEY, Graham, B.Sc., (McGill Univ.), engrg. sales, Can. Gen. Electric Co., Ltd., Montreal, Que.

MACAULAY, Robert, Vernon, B.A.Sc., (Univ. of Toronto), acting ch. engr., Bell Tell. Co., Montreal, Que.

SPENCER, Raymond A., B.Sc., (Univ. of Vermont), contracting engr., Can. Bridge Co., Walkerville, Ont.

HANSON, Myron W., C.E., (Ohio Northern Univ.), designing engr., Aluminum Co. of Am., Pittsburgh, Pa.

Associate Members

MORRISON, W. S. E., ch. engr., H.M.C. torpedo boat destroyer Patrician, Esquimalt, B.C.

PORTAS, John, B.Sc., (London Univ.), designing and estimating bridges of various types with Monsarrat & Pratley, Montreal, Que.

SPENCER, Walter Hutchins, M.E. & E.E., (McGill Univ.), designing and constructing, Montreal Light, Heat and Power Co., Montreal, Que.

STUART, William Grey, dist. engr., Water Pr. and Reclamation Service, Edmonton, Alta.

TURNBULL, James Thomson, Dist. Prov. Highway Engr., Red Head, N.B.

WADDINGTON, George Wilfred, B.Sc., (Univ. of B.C.), mine surveyor i/c at Middlesboro Collieries, Ltd., Merrit, B.C.

Juniors

CURREY, Allan Robert, B.A., (Queen's Univ.), final yr. student, mech. engrg., Queen's Univ., Kingston, Ont.

HEWITT, Harold Leslie, B.A.Sc., (Univ. of Toronto), dfting, Kippawa pulp mill, Temiskaming, Que.

Transferred from class of Associate Member to that of Member

AMES, Frederick Thomas, executive engr., Indian State Rys., i/c No. 3 div., Kangra Valley Rly. constrn., Punjab, India.

DONALD, James Richardson, B.A., B.Sc., (McGill Univ.), managing dir., J. T. Donald & Co., Ltd., Montreal, Que.

KILBOURN, Frederick B., gen'l supt. of Co.'s plant, Canada Cement Co., Montreal, Que.

TEMPLEMAN, George Earl, ch. engr., Electric Comm., city of Montreal, Montreal, Que.

Transferred from class of Junior to that of Associate Member

CRAWFORD, Arthur Wesley, B.A.Sc., (Univ. of Toronto), Dir. of Tech. Educ., Dept. of Labour, Ottawa, Ont.

FIFE, Walter Maxwell, B.Sc., (Univ. of Alberta), asst. prof., Mass. Inst. of Technology, Cambridge, Mass.

KEARNS, Norman Henry, B.A.Sc., (Univ. of Toronto), gen. supt. of constrn., Chile Exploration Co., Chuquicamata, Chile, S.A.

KER, Merle Franklin, B.Sc., (Queen's Univ.), engr., i/c constrn., twp. of Stamford, Niagara Falls, Ont.

LIBBY, Philip Nason, B.S., (Univ. of Maine), ch. dftsman and asst. to ch. engr., Riordon Pulp Corpn., Temiskaming, Que.

LOY, John Austin, B.Sc., (McGill Univ.), dist. plant engr., Ottawa Bell Telephone Co., Ottawa, Ont.

McCRUDDEN, Harry Elsmere, plant inventory and cost engr., Bell Telephone Company, Montreal, Que.

REID, Anthony Meredith, B.A.Sc., (Univ. of Toronto), div. plant engr., Bell Telephone Co., Toronto, Ont.

WILSON, Eldon Parker, B.Sc., (McGill Univ.), supt., steam power, Brompton Pulp and Paper Co., East Angus, Que.

Transferred from the class of Junior to that of Affiliate

HARVEY, Oscar Robert, manager, radio sales dept., Northern Electric Co., Montreal, Que.

LAKE, Henry Morton, i/c designs, open hearth furnaces, Algoma Steel Corpn., Sault Ste. Marie, Ont.

Transferred from the class of Student to that of Associate Member

BRAULT, Paul George Adrien, B.Sc., (McGill Univ.), sketcher and checker of details, Mtl.-South Shore bridge, Dom. Bridge Co., Montreal, Que.

BUSS, John, B.Sc., (Queen's Univ.), M.Sc., M.I.T., res. mgr., Kaydeross Paper Co., Rock City Falls, N.Y.

CAMPBELL, Alexander, B.Sc., M.Sc., (McGill Univ.), asst. engr., Dominion Bridge Co., Winnipeg, Man.

CAMPBELL, William A., B.A.Sc., (Univ. of Toronto), B.A., (Queen's Univ.), ch. chemist and factory mgr., Bakelite Corpn. of Canada, Toronto, Ont.

CRAWFORD, James Jackson, B.A.Sc., (Univ. of Toronto), asst. to head of tech. dept., Price Bros. & Co. Ltd., Kenogami, Que.

DECHENE, Theo. Miville, B.Sc., (Ecole Polytechnique), Quebec, Que.

DENEAU, Gaston, B.Sc., (McGill Univ.), with H. S. Taylor, Montreal, Que.

GIBBS, Charles Richard, B.Sc., (McGill Univ.), Engr. sales and plant mgr., Ryther and Pringle Co., Carthage, N.Y.

GRIESBACH, Robert James, B.A.Sc., (Univ. of Toronto), resident engr., Foundation Company, Maniwaki, Que.

HAMEL, Joseph Albert, B.Sc., (McGill Univ.), prof. of science and papermaking, Three Rivers Paper School, Three Rivers, Que.

HUBBARD, Edward B., B.A.Sc., (Univ. of Toronto), structural engr., Watson, Nalle and Gough, Inc., San Diego, California.

McDOUGALL, Stewart Robertson, B.Sc., M.Sc., (Univ. of B.C.), chem. engr., Northern Electric Co., Montreal, Que.

SPRATT, Manard James, B.Sc., (McGill Univ.), designing engineer, C. D. Howe and Company, Port Arthur, Ont.

WHITTEMORE, Carl Raymond, M.Sc., (McGill Univ.), i/c tech. service dept., Cons. Mining and Smelting Co., Trail, B.C.

WYLDE, Charles Napier, B.Sc., (McGill Univ.), ch. engr., Dryden Paper Co. Ltd., Dryden, Ont.

Transferred from the class of Student to that of Junior

DOBSON, Arthur Lea, B.Sc., (N. S. Tech. Coll.), dist. sales mgr., Stone & Webster, Inc., Scotts Bluff, Neb.

DORMER, William John Smylie, B.Sc., (McGill Univ.), Bell Telephone Company, Montreal, Que.

MAXWELL, Edward Gerrard, B.Sc., (C.E.), (McGill Univ.), efficiency engr., Ford City plant of Pittsburgh Plate Glass Co., Ford City, Pa., U.S.A.

McDERMID, George, B.Sc., (Univ. of Manitoba), city sales, Western Steel Products Ltd., Winnipeg, Man.

McQUEEN, Andrew William Fraser, B.A.Sc., (Univ. of Toronto), hydraulic and general engrg. computations and investigations, H. G. Acres & Co., Niagara Falls, Ont.

MUNRO, David John Best, B.Sc., (McGill Univ.), asst. to mech. supt., Quebec Ry. Light and Power Co., Quebec, Que.

PEVZNER, David Isidore, B.Sc., (McGill Univ.), Structural and mech. engrg., and also i/c erection supervision, C. D. Goodman, architect, Montreal, Que.

PRINGLE, George Hugh, B.Sc., (McGill Univ.), on mtce. and extensions of Mead Pulp and Paper Co., Chillicothe, Ohio, U.S.A.

PRINGLE, George Hugh, B.Sc., (McGill Univ.), mtce. and extensions on engrg. staff of Mead Pulp and Paper Co., Chillicothe, Ohio, U.S.A.

TITUS, Ernest Moulton, B.E. and M.E., (Univ. of Sask.), supt., A. W. Heis & Co., Ltd., contractors, Saskatoon, Sask.

WILSON, Valentine William Gibson, B.Sc., (McGill Univ.), student engr's. course, General Electric Co., West Lynn, Mass., U.S.A.

Westinghouse Electric and Manufacturing Company, South Philadelphia, Pa., has issued two very interesting leaflets, the first entitled "Direct Connected Turbine Generator Units" and the second "Geared Turbine Generator Units," being numbers 2000-D and 20293 respectively. The first leaflet describes direct connected turbine generator units of capacities 5, 7½, 10 and 15 kw., while the latter covers geared turbine generator units 75 to 500 kw. for a.c. and d.c. operation. The company has also issued a brief descriptive article on the first arc welded rivetless steel railway bridge, which is to be erected on the line of the Boston and Maine at Chicopee Falls, Mass. This bridge is to be 175 feet long and is to be constructed by the Westinghouse Company with the co-operation and approval of the Boston and Maine Railway. Another interesting short article issued by this company describes what is claimed to be the smallest synchronous motor ever manufactured for practical use. This motor is used for timing the OB watthour meter register manufactured by the company and its rotor is so small that it is claimed that it may be wrapped in a postage stamp.

EMPLOYMENT BUREAU

Situations Wanted

Electrical Engineer

Electrical engineer with eighteen years experience, steam, electrical power plant, transmission and distribution, installation, operation and maintenance of electrical equipment; at present employed as chief electrician in sulphite pulp mill; desires connection with public utility preferably. Available upon two weeks notice. Apply box No. 227-W, Engineering Journal.

Civil Engineer

Graduate civil engineer. Two years practical experience in responsible position. First class instrumentman. Best references. Location of no consequence if possibility for advancement. Apply box No. 228-W, Engineering Journal.

Situations Vacant

Business Opportunity

Partners wanted, resident in the largest cities in Canada, for a business enterprise of substantial type connected with construction trade. Young engineers and architects with business ability, good standing, or established selling connections will find this an excellent opportunity to start to build up a secure business future. Capital required, initiative and personal services for a short organization period. Full particulars to be furnished in mutual confidence. Apply box No. 173-V, Engineering Journal.

Electrical Designer

Electrical designing draughtsman required with experience in hydro-electrical power station design. Apply giving experience, qualifications and salary expected, to box No. 174-V, Engineering Journal.

Draughtsman

Draughtsman wanted familiar with the design of reinforced concrete dams and structural work for hydro-electric power house. Apply box No. 175-V, Engineering Journal.

Mechanical Draughtsman

Wanted immediately, a mechanical draughtsman thoroughly experienced in the design of paperboard mills. Apply, stating experience, references and salary expected, to box No. 176-V, Engineering Journal.

New Construction Company Organized

An announcement has recently been made of the incorporation, under the provincial charter of Ontario, of the Foundation and Construction Company of Ontario, Limited, formed to carry on general contracting business similar to that of the Foundation Company of Canada within the province. The company is part of the large organization of similar companies, among which are the Foundation Company of London, England, and the Foundation Company of New York.

The new company has as its president the Hon. F. H. Phippen, K.C., of Toronto, and as vice-president, R. E. Chadwick, M.E.I.C., of Montreal, while the Toronto office will have as its manager H. V. Serson, A.M.E.I.C.

Mr. Chadwick, who is also general manager of the Foundation Company of Canada, Limited, with headquarters at Montreal, is an honour graduate of the School of Practical Science, University of Toronto, of the year 1906. His course at the university was in mechanical and electrical engineering. Immediately following graduation he was engaged on construction and operation of the Port Credit Brick Works at Port Credit, Ont., with Messrs. Haney and Miller, general contractors. Later in the same year he joined the staff of the bridge department of the Canada Foundry Company, Limited. In June of the following year he entered the firm of Oxley and Chadwick, structural engineers, Toronto, continuing as a partner of this firm until May 1919, and at the same time having the appointment of Fellow in Drawing in the Faculty of Applied Science, University of Toronto. After the dissolution of the firm of Oxley and Chadwick he was employed in the city engineer's office, in Toronto, on maintenance of bridges and docks, and the following year he was appointed engineer on the same work. In June 1911 he entered the employ of the Foundation Company of New York as superintendent of construction of foundations for the Woolworth building, New York, later being appointed to the staff of the Foundation Company of Canada, Montreal, as engineer in charge of estimates. The following year he was in the construction department of the same company as superintendent in charge of construction of various bridge works and later was appointed eastern manager of the company in charge of construction work east of Winnipeg. Since that date he has been connected with the company and has occupied various positions, including: in 1913, engineer in charge of engineering and estimating departments; in 1915, assistant to the general manager, the Foundation Company of New York; in 1916, acting chief engineer of the Foundation Company of New York; and in 1917 he returned to Montreal as manager of the Canadian company. He occupied this position until 1920, when he was appointed general manager.

H. V. Serson, A.M.E.I.C., is also a graduate of the School of Practical Science, University of Toronto, and as early as 1922 he was engaged in electrical work with the Lake Superior Paper Corporation at Sault Ste. Marie. In 1904 he joined the staff of the General Electric Company at Schenectady, N.Y., and in the following year he entered the employ of the Hudson Company in New York on machinery, power plant and foundation design. During 1906 he was with Jacobs and Davies, consulting engineers, New York, later returning to the Hudson Companies, with which he remained for a number of years. He later returned to Canada and during the Great War he went overseas with the Canadian Engineers. During the past year he was engaged on the Gatineau work which was undertaken by the Foundation Company.

Standards for Pipe Flanges and Fittings

An unusually close approach to an ideal piece of standardization work in which the setting up of a new standard has kept pace step by step with a rapidly advancing industry,—just enough in advance to guide the commercial development of the industry,—is shown in a recent announcement by the American Engineering Standards Committee. It is in connection with the completion of the first of a series of standards for pipe flanges and fittings, representing the results of co-operative work on the part of more than a score of organized industrial groups and extending over several years.

This particular standard, which has already come into very general industrial use, is one of a group which are being developed by a very large representative sectional committee, composed of appointees from twenty-eight organizations interested in the subject, under the joint sponsorship of the American Society of Mechanical Engineers, the Heating and Piping Contractors' National Association and the Manufacturers' Standardization Society of the Valve and Fittings Industry.

With the increasing use of high pressure superheated steam, the necessity of authoritative and nationally recognized standard steel pipe flanges and flanged fittings became evident. At the same time, it was desirable to anticipate the advent of still higher steam pressures, as it is the natural trend of modern industry to strive for more and more powerful units.

Several years ago, when the sectional committee began its work, a few steam power plants were in operation at 350 and 400 pounds pressure, and plans were being developed for one or two 600-pound stations. Except for the two lower pressures, the field was therefore entirely clear, and the sub-committee mapped out a series of standard working pressures in geometric ratio, viz., 250, 400, 600, 900 and 1,350 pounds per square inch. These pressures are meant as maximum working steam pressures at a temperature of 750 degrees F., (gauge indication). Eventually the pressures of 2,000 and 3,200 pounds per square inch will be added.

The maximum permissible working pressures for hydraulic applications are correspondingly higher than those for steam applications. Thus, the maximum non-shock working hydraulic pressures at a temperature of 450 degrees F. are 325, 500, 720, 1,080 at 1,625 pounds per square inch, (gauge indication), whereas the maximum non-shock working hydraulic pressures at or near the ordinary range of air temperatures are 500, 750, 1,000, 1,500 at 2,250 pounds per square inch, (gauge indication).

Other standards belonging to the same group have recently been presented for final approval by the American Engineering Standards Committee. These are:—

Cast Iron Pipe Flanges and Flanged Fittings for maximum pressures of 125 pounds, also for 250 pounds.

Malleable Screwed Fittings for maximum pressures of 150 pounds.

Cast Iron Screwed Fittings for maximum pressures of 125 and 250 pounds.

All have been prepared by sub-committees of the same sectional committee. Four more important standards on the same general topic of pipe flanges and fittings are in various stages of development, some of them being now near completion.

Recent Additions to the Library

Proceedings, Transactions, etc.

PRESENTED BY THE SOCIETIES:
The American Society of Civil Engineers: Proceedings.
The American Society for Testing Materials: Year Book 1927.
The Society of Naval Architects and Marine Engineers: Year Book 1927.
The Royal Society of Edinburgh: Proceedings 1926-1927.

Reports, etc.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, GREAT BRITAIN:
Fuel Research Board: Report for 1920-1921: 1st Section, Steaming in Vertical Gas Retorts; 2nd Section, Low Temperature Carbonization; Report for 1922-1923: 1st Section, The Production of Air-Dried Peat.
The Adhesives Research Committee: Second Report.
Engineering Research: Report No. 1. Properties of Materials at High Temperatures—1.
The Committee of the Privy Council for Scientific and Industrial Research: Report for 1925-1926.

DOMINION OF CANADA:
Report of the Minister of Mines.

DEPARTMENT OF TRADE AND COMMERCE, CANADA:
Bureau of Statistics, External Branch: Summary Trade of Canada, Trade of Canada with United Kingdom, Trade of Canada with United States.

DEPARTMENT OF MINES, CANADA:
Mines Branch: Abrasives, Part 1. Silicious Abrasives.
Geological Survey: Memoirs 144, La Region Cartographiée du Mont Albert, Quebec, Part C. Rapport Sommaire 1924.
Division of Explosives: Annual Report 1926.

DEPARTMENT OF THE INTERIOR, CANADA:
Dominion Water Power and Reclamation Service: Water Resources Paper No. 52, Atlantic Drainage.
Forest Service Bulletin No. 78. Some Commercial Softwoods of British Columbia.

NATIONAL FOREIGN TRADE COUNCIL:
Canada-United States Trade.

THE QUEBEC STREAMS COMMISSION:
Report 1926.

DEPARTMENT OF MINES, ONTARIO:
Part 1-6, Annual Report 1926, Bulletin 61, Mineral Production of Ontario.

DEPARTMENT OF COMMERCE, UNITED STATES:
Bureau of Standards: Tech. Paper No. 344, Comparison of American, British and German Standards for Metal Fits.
Bureau of Mines: Mineral Resources of the United States in 1926.

TREASURY DEPARTMENT, UNITED STATES:
Public Health Service: Reprint 1096, Benzol Poisoning as an Industrial Hazard; Public Health Bulletin 157, Health Hazards of Brass Foundries.

SEWERAGE AND WATER BOARD OF NEW ORLEANS, LA.:
Semi-Annual Report 1926.

IRON AND STEEL INSTITUTE:
Advance Copies: High-Frequency Induction Melting, Magnetic and Other Changes Concerned in the Temper-Brittleness of Nickel-Chromium Steel, The Solution of Cementite in Iron and Its Precipitation, A Testing Machine for Repeated Impact, and A Preliminary Investigation on the Effects of Repeated Impact on Lowmoor Iron, On the Theory of the Blast-Furnace Process, The Behaviour of Mild Steel Under Prolonged Stress at 300°C, The Economic and Social Development of the American Iron and Steel Industry, On the Qualitative Measurement of the Cutting Power of Cutlery, The Use of Silica Gel as a Medium for Drying Blast, On the Mechanism of the Tempering of Steels, The Work-Hardening of Steel by Abrasion, The Constitution of Silicon-Carboniron Alloys and a New Theory of the Cast Irons, The Effect of Varying Ash in the Coke on Blast-Furnace Working, The Influence of Cold-Rolling and Subsequent Annealing on the Hardness of Mild Steel, The Influence of Nickel and Silicon on an Iron-Carbon Alloy.

Technical Books, etc.

PRESENTED BY THE AUTHOR:
Castles in the Ether, by John Wills Cloud.

PRESENTED BY THE AERONAUTICAL RESEARCH COMMITTEE:
The Spinning of Aeroplanes, by S. B. Gates and W. L. Bryant.

PRESENTED BY THE NATIONAL RESEARCH COUNCIL, JAPAN:
The Industrial Transition in Japan, by Maurice Holland.

PRESENTED BY THE STANFORD UNIVERSITY PRESS:
Machine Work, by Theron J. Palmateer.

PRESENTED BY D. VAN NOSTRAND COMPANY:
Standards and Tests for Reagent and C.P. Chemicals, by Benjamin L. Murray.

PRESENTED BY HENRY CAREY BAIRD AND COMPANY:
The Metallurgy of Aluminium and Aluminium Alloys, by Robert J. Anderson.

BOOK REVIEW

The Working of Aluminium

By Edgar T. Painton. Chapman & Hall Limited, London, 1927. Buckram, 5½ x 8½ in., 210 pp., figs., tables, $3.75.

The use of aluminum in industry is at least three times as great as it was fifteen years ago, and many metal workers have now to make repair articles of this metal. The standard procedures with iron, steel and brass cannot usually be applied to aluminum, and special methods must be learnt and experience gained in working it. In this book the author explains the principles that should be followed in the different branches of such work and gives a very clear account of the methods to be employed.

The word aluminium in the title includes the pure metal and also alloys consisting largely of this metal but containing smaller amounts of other metals which make it harder and stronger. The book deals with the properties of the sheet metal (pure and alloyed), the heat treatment of sheet metal, the alloys used for casting, the method of melting and mixing these alloys, the production of castings, acetylene welding, soldering, electric welding, riveting, sheet metal working, workshop practice and the finishing of articles of aluminum.

The author is thoroughly familiar with the working of aluminum and its alloys and the book is clear and well written. The book describes English practice and the author employs the older spelling "aluminium" which has long been discarded by technical writers on this continent. Some of the English technical terms, "paraffin oil" for example, may not be familiar to all Canadian readers. The book is well printed with excellent illustrations on very thick paper which makes it appear about twice as large as it really is. It will be of value to those who are required to work aluminum and its alloys and to all who have to design castings or sheet work of this metal or to superintend its production.

ALFRED STANSFIELD, M.E.I.C.

C.E.S.A. Publications

The Canadian Engineering Standards Association has recently issued two standard specifications, the first, C-21-1927, being a Standard Specification for Control Cable for Electrical Power Plant Equipment, and the second, A-20-1927, being a Standard Specification for Moveable Bridges. These specifications, together with any others previously issued, may be secured at a cost of twenty-five cents per copy, either direct from the secretary of the association, B. Stuart McKenzie, M.E.I.C., Jackson Building, Ottawa, Ont., or from the headquarters of The Engineering Institute of Canada at Montreal.

The specification on control cable for electrical power plant equipment covers not only a coloured code so that the colouring of braids will follow a definite plan for the purpose of cable identification, also specifications covering the construction of the cable itself.

A specification of moveable bridges was included in the first edition of the C.E.S.A. Specification for Steel Railway Bridges, published in 1920, but was omitted from the second edition of that specification, which was published in 1922, as it was then decided to publish it as a separate specification.

The Early History and Development of the Nickel Industry*

Historically nickel is a very old metal. Some old coins of a copper-nickel alloy have been found dating back to 235 B.C. Where the nickel came from or how the coins were produced is not known. In all probability nickel was not known as an element but occurred with copper in an ore and was produced directly from the ore as an alloy, in a manner similar to the production of Monel Metal today. At any rate, if nickel were known as an element in those early days it was evidently forgotten for a good many centuries. So that from a commercial standpoint, at least, it must be considered a modern metal.

Nickel was first mentioned in literature in 1694 by Hiarni, who described an ore which resembled copper and contained copper, but from which no copper could be extracted. Hiarni called this ore copper-nickel—the nickel, in German, signifying "false" or "devil's" copper. Hiarni, therefore, gave nickel its name, although he did not discover the element.

Nickel was first isolated as an element in 1751 by Cronstedt. Its varied and peculiar chemical and physical characteristics made it a baffling problem for those early metallurgists, and it was nearly a hundred years later before its useful properties were recognized. Those very properties, however, which earned for it the name of "devil's metal" have made it today one of the most useful metals in the arts.

Sources of Nickel

The three principal sources of nickel are as follows:—

(1) Copper-nickel bearing pyroholite in which the chief nickel-bearing mineral is pentlandite. This is by all odds the most important source of nickel and is found chiefly in the Sudbury district and to some extent in Norway; the Sudbury deposits comprising the largest known supplies of nickel in the world. The known deposits being sufficient for possibly a hundred years at the present rate of consumption.

(2) The silicates or oxidized ores in which garnierite is the chief nickel-bearing mineral; found principally in New Caledonia, an island in the Pacific ocean east of Australia, formerly a French penal colony.

(3) The arsenical ores of nickel and cobalt found in northern Ontario and to some extent on the continent in Saxony and elsewhere. A fourth and more recent source of a small amount of nickel is as a by-product of the electrolytic copper refineries. A great many copper ores carry minute quantities of nickel which accumulates in the electrolyte and periodically has to be removed. The nickel usually finding its way to the market as nickel salts used in electroplating.

The Sudbury District

In 1856 Murray noted in his report to the Geological Survey that a surveyor named Slater, while running a meridian line, noticed a strong deviation of the compass needle near what is now the Creighton mine. Investigating the cause of the deviation, he found an outcropping of magnetic trap rock. Samples of this rock were sent to the department, which reported that it was magnetic pyrite containing small amounts of nickel and copper. No particular importance seems to have been attached to these samples, however. Nickel was of no great importance and the region very inaccessible. Nothing further was heard from this district until 1883, when the Canadian Pacific Railway Company uncovered some mineral in one of their railroad cuts.

Samples were sent to Dr. Selwin, then head of the Geological Survey, who pronounced them of no commercial value. Two years later Dr. Selwin reversed his pronouncement and reported 9 per cent copper; nickel was not detected, or at least not reported. The report of the copper ore caused a great scramble for claims and a great many were staked. In 1886 Mr. S. J. Ritchie organized the Canadian Copper Company and began mining in the Stobie, Evans and Lady MacDonald mines. They mined in that year some 3,000 tons which, after sorting, graded 15 per cent copper. Still there was no thought of nickel. This ore was shipped, partly to Mr. Herreschoffe at the Nichols Copper Company on Long Island, New York, and partly to Col. R. M. Thompson's refinery at Bayonne, N.J., then known as the Orford Copper and Sulphur Company.

The Canadian Copper Company, having shipped their ore, waited patiently for the smelter results. Finally they received a letter from Mr. Herreschoffe stating that they could accept no further shipments; there was something very strange about the ore; it contained copper, lots of it, but they were not able to produce copper metal from it.

It may be recalled that this experience of the Nichols Copper Company was very similar to that of Hiarni some two hundred years earlier.

In the meantime Col. Thompson was having a similar experience at the Orford works. They smelted some of the ore in a blast furnace, producing a matte which they then attempted to refine in a reverberatory furnace. This was the regular method at that time for producing copper, but no copper was produced. After furnacing the material for a week, practically the whole charge was skimmed out as slag. The old copper refiners were very much puzzled over this strange behaviour. The chemists were then set to work to find out the cause of the trouble, and they finally reported nickel. This news was received at the mines with great dismay, because there was then no known method for separating copper from nickel, and the presence of nickel in the ore apparently ruined what they thought was a good copper property.

For a number of years, however, nickel had been growing in importance for electro-plating and at this time commanded a price of $5.00 per pound. Whenever there is a strong demand for an article at a high price and the raw materials are at hand, some means will always be found for producing that article. So in this case, after a great deal of experimental work, the so-called "Orford Process" for the separation of copper and nickel by means of sodium sulphide was developed and the production of both nickel and copper on a commercial scale was begun.

Nickel Markets

No sooner had this been accomplished, however, than they found that the world's consumption of nickel was very limited, and it was necessary to find or rather create new markets if the enterprise was to prosper. In this connection there is an interesting story. In the late seventies there was an epidemic of yellow fever in the southern states. It was known that yellow fever germs could not thrive in a cold atmosphere. An Englishman by the name of Gamgee conceived the idea of building a refrigerated hospital ship which would cruise around the southern ports, take on fever patients and freeze out the bugs. Gamgee was employed by Congress to build an experimental refrigeration plant. He soon found that cast iron pipe would not stand the high pressure ammonia gas and he set out to find some other metal or alloy that would be satisfactory. He was led to study the meteorites at the Smithsonian Institution, which were alloys of iron and nickel containing usually about 9 per cent nickel and known to be a particularly tough metal. He then secured some nickel and made up some alloys with varying percentages of nickel, which proved entirely satisfactory for his work. Gamgee had some disagreement with the Senate Committee, which had the matter in charge, and threw up the job and the whole project was abandoned. He had, however, accomplished one very important thing. He had produced a new alloy steel which held great commercial promise. Now it so happened that Mr. Ritchie, who organized the Canadian Copper Company in 1886, was a friend of Gamgee and had assisted him in his hospital ship enterprise and was familiar with the nickel steel which he had produced. When Mr. Ritchie found that he had a nickel mine instead of a copper mine he immediately thought of the iron nickel alloy which Gamgee had produced and attempted to interest the steel workers, particularly the Krupps of Germany, but met with no success. The negotiations had been carried on by correspondence and he then determined to personally interview the English steel makers. The United States and Canadian governments co-operated with him, the former appointing Lieutenant Buckingham and the latter Sir Charles Tupper to assist him. They succeeded in interesting James Riley, a well-known steel maker of Glasgow, supplying him all the data from the Gamgee experiments. Riley made up some nickel-steel alloy and wrote a paper on them, which he presented before the Iron and Steel Institute of Great Britain in 1889. A copy of this report was sent to Benjamin F. Tracy, secretary of the United States navy. Tracy was immediately interested and ordered an armour plate of nickel-steel from Crusot in France, and for comparative purposes an English steel armour plate which the British Admiralty were specifying at that time for their battleships. These plates were tested out at the Annapolis proving grounds and the nickel-steel proved far superior. Tracy laid his reports before the United States Congress and there was immediately appropriated $1,000,000 for the purchase of nickel. Col. R. M. Thompson secured the contract to supply the nickel. That was the real beginning of the nickel industry. It seems a far cry from yellow fever to nickel steel. Yet the modest experiments of Gamgee in 1876 have resulted in covering with nickel-steel every first class battleship in the navies of the world.

Uses of Nickel

From the inception of nickel-steel until after the great war its principal use was for armour plate and ordinance. At least 75 per cent of the production was so used. At the expiration of the war

* Address by Mr. Herbert Walter upon the occasion of the visit of the members of the Niagara Peninsula Branch to the works of the International Nickel Company.

and particularly after the Washington disarmament conferences, the bottom dropped out of the nickel industry. It was in about the same position that Mr. Ritchie and Colonel Thompson found themselves some twenty-five years earlier. It was again necessary to find new markets. The International Nickel Company met this situation by setting up a research and development department for developing and extending the use of nickel-steel and the various alloys of nickel in the industrial arts. Particularly interesting among the alloys is Monel Metal, the natural alloy of nickel and copper, produced directly from the ore; also the extended use of pure nickel in the form of sheets, rods, seamless tubes, etc.

As a result nickel tonnage has surpassed pre-war tonnage with this very important difference. Before the war some 75 per cent of the nickel produced was used in armour plate and ordinance. To-day less than 5 per cent is so used. Instead of a war materials industry, nickel has developed into a peace time industry with a widely diversified industrial field and is consequently on a much firmer foundation.

BRANCH NEWS

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, A.M.E.I.C., Branch News Editor.

Lectures on Cement

A series of three lectures on "The Design and Control of Concrete Mixtures" was given by Mr. R. S. Phillips of the Portland Cement Association on the evenings of September 19th, 21st and 22nd. The meetings were open to engineers and contractors. The attendance at all meetings was good. W. L. McFaul, M.E.I.C., the vice-chairman of the branch, introduced Mr. Phillips and touched briefly on the work of the Portland Cement Association laboratories in Chicago and the assistance it had been to the engineering profession and contractors of the continent.

The Portland Cement Association's booklet on "Design and Control of Concrete Mixtures" was distributed to all those present, and several other publications and specifications of the association were available for reference.

Mr. Phillips is an interesting and convincing talker, and not only succeeded in holding the attention of his audience from a technical standpoint but brought out his points in a way that appealed to anyone interested in the application of cement in road building, in construction or in residence building.

The same lectures were presented before the Montreal Branch recently and a fairly complete report of the subject matter is given in the Montreal Branch News, published on page 474 of the October issue of the Journal.

At the conclusion of the series A. M. Jackson, A.M.E.I.C., county engineer and road superintendent for Brant county, led a short discussion. H. A. Lumsden, M.E.I.C., county engineer and road superintendent for the county of Wentworth, expressed the thanks of the branch to Mr. Phillips for the very useful and interesting series of lcetures.

London Branch

Frank C. Ball, A.M.E.I.C., Secretary-Treasurer.

Design and Control of Concrete Mixtures

The London Branch opened its season on September 27th with the course of lectures on "The Design and Control of Concrete Mixtures" in co-operation with the Portland Cement Association. Notices for this course of lectures, three in number, were sent to a large number of contractors and architects and others who are not Institute members but who might be interested in concrete work. The response to these notices, as indicated by the interest shown at these meetings and by the attendance, proved that the branch was fully justified in arranging the course.

The lecturer, Mr. R. S. Phillips, proved a very capable teacher of the latest methods in concrete design and his careful demonstrations were of great value to those who were interested in the making of better concrete.

In order to make the course of more value to local men, Mr. Phillips chose for his demonstrations the class of material that is used locally. Pit-run gravel is plentiful in this district and is used almost exclusively for concrete. Mr. Phillips showed how greater economy might be obtained by the addition of coarse material to the sample of gravel chosen and still obtain the desired strength.

Those who attended the course were impressed with the advantages to be gained in economy, strength and uniformity by following the methods outlined. Mr. Phillips' explanation of the use of the water-cement ratio made this method and its advantages very clear.

Niagara Peninsula Branch

Walter Jackson, M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

On Saturday, October 1st, the branch held its first fall meeting of the season at Port Colborne.

An unexpected number of members and their friends attended, some seventy-five in all, and although the capacity of the Boone mess-hall was somewhat strained, the staff fairly rose to the occasion and proved that there is practically no limit to the expansion of a well organized camp.

A slight misundertanding was responsible for the notification that a charge was to be made for this dinner, but at the first opportunity Mr. Ed. Manley, superintendent for the C. S. Boone Dredging Company, made it absolutely clear that the members were to be his guests, and he hinted darkly that whosoever was found to be responsible for such a palpable error was in for a great deal of trouble.

After seating seventy in the space ordinarily designed for about fifty-five or less and thereby endangering the walls of the building under the subsequent expansion, the balance was escorted to an adjacent celestial salle-à-manger by E. S. Miles, A.M.E.I.C., who duplicated Mr. Manley's courtesy.

Previously, however, quite early in the afternoon the party met at the works of the International Nickel Company and were instructed in the various processes by which the matte from the smelters at Copper Cliff was broken down and separated into the constituent parts, roughly 30 per cent copper and 50 per cent nickel, with minor proportions of iron, silver, platinum, etc. The ore from the Creighton mine at Copper Cliff runs about 6 per cent metal. This constitutes the matte which is sent to the Port Colborne plant having the above proportions, 30 Cu. and 50 Ni., which is practically the well-known Monel Metal of commerce. Each member was given a chart showing the various steps, thus making it quite simple to follow the metal through the smelting furnaces, leaching tanks, roasting furnaces and electrolytic baths.

The copper, although it forms a large percentage of the matte, is really a by-product and is shipped to manufacturers in pigs, but after the separation of the copper the nickel has to go through many refining processes, finally emerging in a great many forms, black oxide, pigs, bullets and in sheets or clippings from the electrolytic process which is 99.9 per cent pure.

A rather interesting sidelight on the extent of these works and their productive capacity may be obtained from the fact that the freight bills for one year, into and out of this plant, amount to approximately a million dollars a year. Copper production is about two and one-quarter million pounds a month, and nickel capacity output about four and one-half million pounds a month.

After this inspection the visitors embarked on one of the Boone tugs and were taken out through Port Colborne harbour to the new concrete breakwater built by the government as part of the Welland ship canal improvement.

Dinner was then served and afterwards Mr. Herbert Walter, manager of the Nickel company, gave an historical summary of the discovery and utilization of this metal, which was so interesting that he was urged to have it published in the Journal. Through his kindness, therefore, we are able to present the main features to the membership.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

The Arc Welding of Structural Steel

In a graphic, lucid and well-illustrated lecture before the Montreal Branch on October 6th, Mr. Gilbert D. Fish, consulting engineer to the Westinghouse Electric and Manufacturing Company, described the recently developed art of "Arc Welding Structural Steel."

The application of the electric arc to the fabrication of steel structures was, in the opinion of the speaker, a natural sequence to the advancement in the art of arc welding. While this application calls for further study and instruction, and was particularly in need of a standard text book to set forth its ruling principles, its many advantages were now becoming known to the industry. When once its application became more general, the speaker expected that the immobility that it gave to framed structures would be recognized, its economy, availability and suitability would be appreciated, and its adaptation would become permanent.

The first step in introducing such a radical change in existing practices was to establish confidence in this application of arc welding to structural steel. With this in view, a large number of tests were performed at the Carnegie Institute of Technology which convinced the witnesses that welded connections were superior to rivetted connections in every case where direct comparisons were made, that complete continuity of lines of beams can be obtained in welded construction where, as it is well known, this cannot be done in rivetted construction, and that in a welded building it will be possible to make every joint develop full strength of the main members, whereas in a rivetted building many joints are weaker than the members, due to the weakening effect of the rivet holes and the weakness of steel angles which are used for transmitting tension between two members at right angles to each other. These tests were described on page 518 of the December 1926 issue of the Journal.

Confidence having been established, these welded joints were used in the five-storey steel building 70 by 220 feet and 80 feet high, erected for the Sharon Works of the Westinghouse Electric and Manufacturing Company. In this application, the welding process reduced the steel requirements from the 900 tons for a rivetted structure to 790 tons for the welded structure. No trouble was experienced in the erection from any cause and tests on the finished structure proved that expectations had been realized.

In its applications to bridge construction, the speaker presented an example which was even more striking, by showing a 30 per cent economy in steel requirements; nevertheless, he felt its chief application in this case would be its gradual introduction to strengthen many existing bridges while they were still kept open to traffic. For signal bridges, the absence of rivet holes and the need for wide-leg angles, would prove economical. In conclusion, the speaker declared he was convinced it was only a question of time before the rivetted structure would be superceded by arc welded steel frames.

After a large number of members had taken part in the discussion, Major Leroy Wilson, M.E.I.C., in suggesting that the economics of the case, shop facilities, erection requirements and the provision of trained operators, would influence final decision, moved a hearty vote of thanks to the speaker, in which the meeting, presided over by F. P. Shearwood, M.E.I.C., fully accorded.

Induction Regulators

On Thursday evening, October 13th, N. D. Seaton, A.M.E.I.C., of the Canadian General Electric Company, Peterborough, gave an instructive talk on induction regulators, describing fully, with the help of lantern slides, the manufacture and operation of this latest piece of equipment for regulating the power in electrical installations. The paper is given in full elsewhere in the current number of the Journal.

The meeting was presided over by K. B. Thornton, M.E.I.C., and was attended by a considerable number of electrical engineers, many of whom took part in the subsequent discussion, following which, on the proposal of F. C. Laberge, M.E.I.C., a hearty vote of thanks was accorded the speaker.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

An extensive series of luncheons and evening addresses have been arranged by the Ottawa Branch for the fall months. The autumnal activities opened with a visit to the new Gatineau newsprint mill of the Canadian International Paper Company on Saturday afternoon, October 15th. A very large number of members, accompanied in many instances by their wives and friends, took in the trip, leaving Parliament hill in motor cars at 2 p.m.

Visit to Gatineau Newsprint Mill

The members were met at the plant by officials of the Canadian International Paper Company and a tour was made of all departments of the mill, which enjoys the distinction of having the four largest newsprint machines in the world. Together they turn out paper twenty-one feet in width at the rate of nearly a mile a minute. This amounts to 3,385 acres of paper daily, or over a million acres a year. The rated capacity of the plant is 600 tons per day, and all four of the machines are now in operation.

The mill includes both groundwood and sulphite pulp plants, and an efficient corps of guides explained the various processes in paper making to those engineers who were unacquainted with the industry. The enormous consumption of power was of great interest, and in the groundwood plant twelve synchronous motors, each rated at 2,560 kv.a., were seen driving the battery of twenty-four grinding machines. The electrical steam plant drew the attention of everybody. Three units of this plant are each capable of absorbing 4,200 horse power in the generation of steam, while a fourth unit is rated at 2,100 horse power, a total of 14,700 horse power.

The sulphite pulp plant was another point of absorbing interest, especially that part of it devoted to the making of the liquor used in the digestion of the spruce chips. Sulphur, limestone and water are the ingredients which are used in this plant in the preparation of the liquor, and many members tried to fathom the chemical changes which go on in the burning of sulphur and the reaction between the sulphur dioxide gas given off and the limestone and water which it meets in the acid tower.

From the sawing and barking plant where the logs emerge from the Ottawa river and the unloading pier where the sulphur was being taken from a barge to the immense shipping room, the tour was a wonderful education as to the mammoth size of Canada's modern paper mills and everyone had a thoroughly enjoyable afternoon, thanks to the courtesy of the Canadian International Paper Company.

Peterborough Branch

W. E. Ross, M.E.I.C., Secretary-Treasurer.
B. Ottewell, A.M.E.I.C., Branch News Editor.

Dinner in Honour of Paul Manning, A.M.E.I.C.

Many flattering things were said of Paul Manning, A.M.E.I.C., at a farewell meeting held in Hooper's dining room on the evening of August 30th, when Mr. Manning was made the recipient of a fine travelling portfolio, the gift of his fellow members of the Peterborough Branch of The Engineering Institute of Canada, marking his impending departure to take up a position in St. Catharines. The presentation was made by E. R. Shirley, M.E.I.C., who, as the chairman, Arthur E. Caddy, M.E.I.C., remarked, was president of the branch when Mr. Manning was secretary.

Mr. Shirley said that as a professional co-worker of Mr. Manning, both professionally and in civic life, he wanted to express the general gratitude of the community to Mr. Manning for his past labours and especially the thanks of the branch for his untiring efforts. The duty he was called upon to perform was both pleasant and unpleasant. It was pleasant to be given the opportunity to say nice things of Mr. Manning and to thank him for what he had done. It was unpleasant because the meeting marked the loss of a valued member of the branch. Mr. Manning came to Peterborough soon after the inception of the local branch, and ever since he had been a source of strength and a potent factor in its development. His departure would create a loss that would be very hard to make up. Mr. Manning had been active in every phase of the work. Any work that was to be done in connection with branch activities found Mr. Manning ready to get down to business. He was both at the back and the front of things. Although they would miss him they congratulated the other branch on gaining him. They hoped he would take every opportunity of coming back to renew old acquaintances in Peterborough.

Mr. Manning on rising to reply was greeted by the singing of the chorus "See Him Smiling." He said he was not enjoying the dinner at all. He would have enjoyed himself much better had be been down at the end rather than at the head table. He was one of the unluckiest individuals alive. He had a wonderful speech ready for the corn roast that was to be held the night previous, but the rain came and spoiled the whole thing, and he had forgotten his speech. Last year they had a very successful corn roast down the river. He had heard various whispers since then that it might be a good idea to have another. So they had made him the goat. (Laughter.) They had made his going away the occasion for getting together for a good feed. He hated to leave Peterborough and the boys of the E.I.C. He had tried to do his best for the branch. During the last few days he made a discovery. In going among the younger engineers in an effort to get recruits for the branch the question had often been put to him: "What is there in it?" It was only in these last days that he had discovered what was in it. There was nothing more in it than fellowship. When they reflected, they would find this to be the case as he had found it. If anyone had said to him six weeks ago that he would be in such a gathering to see him away, he would not have credited it. He urged the desirability of getting the younger engineers into the branch. Peterborough was known as a lively branch. He urged them to keep it up. They had something to live up to. What they would get out of the branch would depend on what they put into it. If a man put nothing into the branch, he would certainly get nothing out of it.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

The regular meeting was held in the Y.W.C.A. rooms on September 30th, at 8 p.m. following a dinner.

G. H. Kohl, M.E.I.C., chairman, called the meeting to order and disposed of the regular business before calling upon C. H. Speers, M.E.I.C., who showed thirty-eight slides on the steel industry in this province. These slides and the descriptive address that went with them is being prepared by the Ontario Department of Education to be shown throughout the province in the different schools. Mr. Speer assisted in the making of the slides and prepared the lecture himself. First was given the early history, general geographical location and shipping facilities of the Algoma Steel plant at Sault Ste. Marie, Ont. The manufacture of coke and gas, the handling of coal and iron ore and all the different stages leading up to and the manufacture of steel itself were clearly shown and explained.

A very instructive discussion followed and a hearty vote of thanks was tendered to Mr. Speer by all present, as they all fully realized the amount of energy that had been spent in preparing this lecture.

Victoria Branch

K. M. Chadwick, M.E.I.C., Secretary-Treasurer.

Opening of Esquimalt Drydock

On July 1st, the members of the Victoria Branch were invited by the Diamond Jubilee of Confederation Celebration Committee to attend the opening of the new drydock at Esquimalt, the building of which cost $6,000,000.

Chief Justice J. A. MacDonald, in the absence of the Lieutenant-Governor, took the leading part in the opening ceremony, unveiling a tablet commemorating the finishing of the dock. The inscription on the tablet reads:—

> Esquimalt Drydock, Commenced 1921, Completed 1927; Ministers—Hon. F. B. McCurdy, Hon. J. H. King, Hon. J. C. Elliott; Deputy Minister—James Blake Hunter; Engineers—K. M. Cameron, M.E.I.C., Chief Engineer, J. P. Forde, M.E.I.C., District Engineer. Board of Engineers on Design—Dr. A. R. Decary, M.E.I.C., E. E. Brydone-Jack, M.E.I.C., Lieut.-Colonel H. J. Lamb, M.E.I.C., Alexander Gray, M.E.I.C., W. A. Gourley. Contractors—P. Lyall and Sons Construction Company, Limited.
>
> This Tablet was unveiled by the Hon. James Alexander MacDonald, Chief Justice of the Court of Appeal, on the Sixtieth Anniversary of Confederation.

J. P. Forde, M.E.I.C., acted as chairman of the ceremony, while W. A. Gourley was the first speaker. Commenting on the fact that government work often cost a great deal more than originally contemplated, he said that the drydock had been completed at a cost within two per cent of the original estimates.

G. B. Mitchell, M.E.I.C., representing the contractors, paid tribute to the personnel of the engineers and inspectors, saying:—"The government engineers have been everything anybody could ask for, courteous and helpful. As to their ability—you have the dock."

Speaking for the shipowners, Captain Neroutsos, assistant manager of the B.C. Coast Steamship Company, dwelt on the development of shipping to and from Victoria.

"When you look back to the opening of the naval graving dock in 1887, when 1,120 vessels called here with a gross tonnage of a million tons, which in 1926 has increased to 4,349 ships with a gross tonnage of twelve million tons, you realize that it is the maritime situation to which our province owes its commercial prosperity. The awakening of the Dominion government to this situation is demonstrated in the construction here of the second largest drydock in the world, and this, coupled with the splendid equipment and the excellent salvage plant and shipyards at our disposal, places British Columbia in an unassailable position in the sphere of marine affairs."

Norman A. Yarrow, A.M.E.I.C., representing the ship repairers and shipbuilders, predicted that this port was to be the Liverpool of the Pacific. The new dock is 1,150 feet long by 124 feet wide by 40 feet deep.

Visit to Jordan River Power Plant

On August 10th, on invitation of Mr. A. T. Goward, vice-president of the B.C. Electric Railway Company, some thirty members

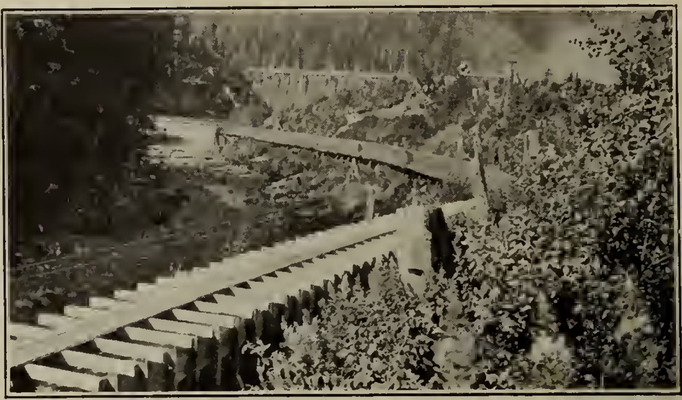


Figure No. 2.—Flume at Jordan River Power Development.

and friends of the Victoria Branch visited the Jordan river hydro-electric development. The party, headed by Mr. G. M. Tripp, general superintendent of the company, left by cars from the head offices of the company soon after 9 a.m., arriving at the power house, some thirty-seven miles away, about 11.30 a.m., and were shown over the power house, which contains three units, the two older units developing 6,000 horse power and the last unit 13,000 horse power.

The party then went outside the power house to examine the forty-four inch diameter pressure pipes and the tail race. All this interesting work took some time, and when the 12 o'clock whistle blew the party was quite ready for a sumptuous luncheon which the company provided in its recreation room.

At the conclusion of the lunch, R. F. Davy, A.M.E.I.C., vice-chairman of the Victoria Branch, called on J. N. Anderson, A.M.E.I.C., who expressed, on behalf of the members of the party, his appreciation of the kindness of the company. The party then entered the automobiles again and were driven up to the balancing reservoir, some two miles from the power house and 1,145 feet above it.

After viewing the reservoir, the party was carried by a light railway which the company had built some four and a half miles along the valley to the Jordan river dam, viewing on the way the flume, which follows the east side of the Jordan river except for a short distance just below the Jordan river dam, where it crosses to the west side of the river by means of a concrete aqueduct. During its course, the flume crosses several deep gulches by means of high trestles. Several of these trestles are being replaced with permanent structures built of reinforced concrete.

The Jordan river dam is about seven and one-half miles above the power house. It is a hollow reinforced concrete structure of the Ambursen flat slab and buttress type, and proved of great interest to the members, who spent considerable time examining it.

Upon their return, the members of the party were again entertained by the company to an excellent tea. After tea, R. F. Davy A.M.E.I.C., called on Captain W. M. Everall, A.M.E.I.C., as chairman of the social committee, to speak. Captain Everall, in a few words, thanked Mr. Tripp and the company for their hospitality. These sentiments were endorsed by E. G. Marriott, A.M.E.I.C., and very heartily applauded. Mr. Anderson, a visitor from Glasgow, Scotland, also expressed his appreciation. The party was conducted by Mr. G. M. Tripp, Mr. Horsey and Mr. T. R. Myers and others of the staff.

Figure No. 1.—Visit of Members of Victoria Branch to Jordan River Power Plant.

Figure No. 3.—Dam on Jordan River.

Preliminary Notice

of Applications for Admission and for Transfer

October 17th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in November 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AHARA—EDWARD VICTOR, of Westmount, Que., Born at Beloit, Wis., Apr. 29th, 1902; Educ., B.A.Sc., Univ. of Toronto, 1922; 1922-24, gas and oil engine bldg. and testing, also i/c repair dept., Can. Fairbanks-Morse factory, Toronto; fall of 1924, heating and ventilating design, J. M. Duncan, Toronto; 1925 to date, with Combustion Engrg. Corp., as: 1925-26, steam engineering; at present, head of steam accumulator dept.

References: E. A. Allcut, R. W. Angus, J. G. Hall, T. S. Morrisey, N. E. D. Sheppard.

EYRE—ROBERT THORNTON, of Toronto, Ont., Born at Toronto, May 16th, 1894; Educ., S.P.S., Toronto, two and a half yrs.; overseas as pilot with R.N.A.S.; 1919-24, estimator and supt. gen'l bldg. constrn. as jr. partner with father; 1924-26, similar position with T. Thompson, Toronto; Oct. 1926 to date, in city architect's dept., Toronto, as plan examiner, checking mill steel and concrete constructed bldgs. of all types for strength of structure.

References: W. L. Sagar, H. Horsfall, F. N. D. Carmichael, P. M. Thompson, H. N. Mason, J. K. Affleck.

FLEURY—J. ERNEST, of Three Rivers, Que., Born at Three Rivers, Oct. 16th, 1891; Educ., B.A., C.E., 1917, chemical engr., 1918, Ecole Polytechnique; 6 mos., Quebec Streams Comm.; 3 yrs. shift chemist, Wayagamack Pulp & Paper Corp.; 1 yr. chemist, St. Maurice Paper Co.; 2 yrs. ch. chemist with St. Lawrence Pulp & Paper Co.; 4 yrs. asst. principal at Government Papermaking School, Three Rivers; May to Oct. 1925, asst. engr. of city of Threo Rivers; July to Sept. 1927, asst. engr. of city of Cap de la Madeleine; at present, asst. principal at Papermaking School, Three Rivers.

References: B. Grand Mont, R. Morrissette, C. H. Jette, C. Arcand, S. W. Slater.

HALE—GEORGE RAYMOND, of Montreal, Que., Born at Boston, Mass., July 25th, 1889; Educ., S.B., 1912, M.Sc., 1916, Harvard Univ.; 1912-14, student engr., C.G.E. Co., Lynn works; 1915 (summer), steam turbine test with same Co.; 1916 to date, employed by Shaw. Water & Power Co. and its subsidiary companies; 1916-18, supt. i/c installation of machinery, experimental work for development of process and operation on a commercial scale, Can. Electrode Co.; 1918-26, elect'l engr., tech. dept.; 1926 to date, elect'l engr. in operating dept. of Shaw. Water & Power Co., working on transmission line calculations, regulation of river flow, power estimates and general operating data.

References: J. Morse, C. V. Christie, C. R. Lindsey, A. S. Runciman, C. S. Saunders, A. B. Rogers, A. L. Patterson, F. S. Keith.

HEROUX—JOSEPH EDMOND NAPOLEON, of Montreal, Born at Yamachiche, Mar. 4th, 1887; Educ., B.A.Sc., Laval Univ., 1915; 3 summers, dept. of P.W., Three Rivvers; 2 summers, road dept. of Quebec; 3 yrs. i/c bridges and 5 yrs. divisional engr. with road dept., Quebec; 6 mos., St. George & Gauvreau, contractors; 6 mos. Quebec Streams Commission; 3 yrs. and at present, with tech. service, city of Montreal, as asst. engr.

References: G. R. MacLeod, J. G. Caron, O. Lefebvre, A. Fraser, L. T. G. Boisseau.

HUMPHREYS—DAVID, of Deer Lake, Nfld., Born at Liverpool, Eng., Nov. 1887; Educ., City & Guilds diploma, Darlington and Manchester Tech. Colleges; 1904-09, pupil apptce and dftsman, Robt. Stephenson & Co., Darlington, Eng.; 1907-16, dfting and design with R. Stephenson & Co., Nasmyth, Wilson & Co., Cedar Rapids Mfg. & Power Co., Montreal, and Shawinigan Water & Power Co.; 1916-19, lieut. engr., Independent Air Force in France; 1919-21, with Shawinigan Water & Power Co.; 1922 to date, as asst. to ch. engr., hydro-electric dept., Sir W. G. Armstrong Whitworth & Co., London, Eng., and later i/c field work, installing hydro control equipment and auxiliary plant on the Humberarm Development, Nfld.

References: D. A. Evans, J. B. Gough, L. R. Brown, S. Sly, R. L. Weldon.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

DAVIS—SYDNEY HERBERT, of Ottawa, Ont., Born at Ottawa, Apr. 13th, 1893; Educ., B.Sc., McGill Univ., 1923; 1923-24, field engr. on examination of mining prospects for R. E. Granville, N.Y.C.; 1924-25, engr. on mill investigations at Hawkesbury and Temiskaming mills, research dept., Riordon Corp.; 1925-26, instrumentman on Bitobee storage dam and Chelsea power devel. with Can. Int. Paper Co.; 1926 to date, asst. res. engr. on constrn. highways and bridges at Chelsea and Paugan falls, with Gatineau Power Co.

References: G. G. Gale, S. Wang, R. Ford, R. S. Baker, N. E. D. Sheppard, J. B. Porter, R. H. Reid.

FAHEY—JAMES VINCENT, of Sturgeon Falls, Ont., Born at Elgin, Ont., Feb. 24th, 1894; Educ., B.Sc., Queen's Univ., 1921; 1910 (summer), chainman, C.N.R. survey; 1915 (summer), rodman, Geological Survey, Pas, Man.; Nov. 1919 to Sept. 1920 and May 1921 to Dec. 1926, field engr., hydraulic dept., Spanish River Pulp & Paper Mills, Ltd., work covered compilation of hydraulic records in office, selection and installation of current meter rating stations, topographic survey of dam sites, etc.; 1926 to date, res. engr. at Sturgeon falls mill for same Co.

References: C. H. L. Jones, J. L. Lang, G. H. Kohl, H. A. Morey, R. A. Campbell.

HIGGINS—EDGAR CLARENCE, of Toronto, Ont., Born at Montreal, Que., Mar. 28th, 1894; Educ., 4 yrs. Mtl. Tech. School, 2 yrs. course in structural steel at Dom. Bridge Co.; 1912-19, dfting and checking steelwork and general plant work, Dom. Bridge Co.; 1919-20, dfting and checking steelwork, Phoenix Bridge Works, Montreal; 1920-21, designing, checking and inspection of steelwork and gen'l bldg. constrn. with Can. Allis-Chalmers, Ltd.; 1921-22, designing and checking steelwork and gen'l bldg. constrn. with H.E.P.C., Ont.; 1922 to date, asst. engr. i/c engrg. work on Queenston generating station and other developments with H.E.P.C., Ont.

References: H. E. Brandon, J. W. Falkner, H. V. Armstrong, E. Hugli, J. A. Knight, R. B. Knight, J. Hyslop.

LUCAS—LESLIE, of Timmins, Ont., Born at Annan, Scotland, Aug. 13th, 1896; Educ., Royal Tech. College, Glasgow, 5 yrs. apptce. with Mavor & Coulson, Ltd., Glasgow, 1 yr. journey tester with same firm; 1914-19, in Imperial army, holding rank of captain from 1917; Sept. to Dec. 1923, dfting, with Fraser Brace, Ltd.; 1924-26, supt. of plant and transmission lines, Great Northern Power Co., Indian Chutes, Ont.; 1926 to date, plant mgr., Northern Canada Power, Ltd.

References: H. E. Pawson, J. S. H. Wurtele, J. H. Trimingham, J. B. Woodyatt, C. R. Murdock.

RYAN—CHARLES WILBERT, of New York, N.Y., Born at Mount Forest, Ont., Aug. 10th, 1892; Educ., B.Sc., McGill Univ., 1916; 1914 and 1915 (summers), rodman, D. of C. and B.C. govts.; 1916-19, with Turner Constrn. Co., N.Y.C., as rodman, engr., asst. supt. of constrn., supt. of constrn.; 1921-26, supt. of constrn. with following: J. W. Ferguson Co., Peterson, N.J.; James Stewart & Co., Inc., N.Y.C., White Constrn. Co., N.Y.C.; James Baird & Co., N.Y.C.; Harper Organization, N.Y.C.; at present, gen. supt. of constrn., Industrial Engrg. Co., N.Y.C.

References: E. Brown, F. B. Brown, R. de L. French, H. M. MacKay, C. M. McKergow.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

CODE—MELVILLE CLARKE, of Toronto, Ont., Born at Morris, Man., Mar. 23rd, 1900; Educ., B.Sc., Univ. of Manitoba, 1926; 1922-23-24-25 and 26 (summers), with reclamation branch of Man. Prov. Govt.; 1926-27, demonstrator in elect'l lab.. Univ. of Man.; at present, taking C.G.E. Co.'s students' course.

References: E. P. Fetherstonhaugh, J. N. Finlayson, H. A. Bowman, W. M. Cruthers, L. D. W. Magie.

COWAN—LUCIEN, of Montreal, Que., Born at Paris, France, Apr. 6th, 1900; Educ., medallist, Mtl. Tech. School, 1918, Commercial & Tech. High School, 3 yrs., 1914; 1918 and 19, dftsman i/c Mason Regulator & Engrg. Co., Mtl.; 1919-27, mgr., engrg. dept., Crane, Limited, Mtl., i/c employees' study course as instructor, 1924 to present time.

References: P. Seurot, H. S. Taylor, H. M. MacKay, W. H. Wardwell.

FRANKS—SELWYN THOMPSON, of Montreal, Que., Born at Weston, Ont., Sept. 21st, 1899; Educ., B.A.Sc., Univ. of Toronto, 1924; 1917-19, R.A.F., Canada and abroad, with rank up to flight commander; 1920 (summer), asst. to res. engr., transmission line and railroad constrn., with Lang & Ross, Sault Ste. Marie, Ont.; 1921-22-23 (summers), instrumentman on location, supervision of constrn. and inspection of highways with dept. of highways of Prov. Sask.; at present, research and development work on elect'l power conductors with Northern Electric Co., Montreal.

References: W. C. Adams, W. S. Vipond, N. L. Morgan, W. H. Eastlake, W. G. Tyler, N. E. D. Sheppard.

ROWAT—G. H., of Toronto, Ont., Born at Glasgow, Scotland, Apr. 21, 1897; Educ., B.A.Sc., Univ. of Toronto, 1924; 2½ yrs. during the war, asst. foreman with Russell Motor Car Co.; 2 yrs. varied mech'l work with Steel & Radiation Co., K. & S. Tyre and Rubber Goods, Sunlight Soap Works, Wm. Davies Co.; since graduation to present time, with Can. S.K.F. Co., as sales engr., general advisory and design in connection with selling, application installation and operation of anti-friction bearings in all types of machines and transmission equipment.

References: E. A. Allcut, C. B. Hamilton.

STEWART—DONALD LAUGHLIN, of Montreal, Que., Born at Dunvegan, Ont., Oct. 18th, 1894; Educ., B.Sc., McGill Univ., 1924; 1917-18, Steel Company of Canada, Can. Tube & Iron Co., Ltd., and P. Lyall Constrn. Co. as inspector and lathe hand; 1920 (summer), Hall Engrg. Co., i/c wharf office; 1922 (summer), Can. Car & Foundry Co. as shop hand; 1924 to date, with Bell Tel. Co. in outside plant div. of gen. engrg. dept., spec. studies on utilization of creosoted Can. woods, standardization of outside plant materials and tools and supervision of inspection dept.

References: G. M. Hudson, J. L. Clarke, C. M. McKergow, H. C. Nourse, W. H. Slinn.

The Forty-second

ANNUAL GENERAL *and* GENERAL PROFESSIONAL MEETING

will be held at MONTREAL *on*

FEBRUARY 14TH, 15TH AND 16TH, 1928

The Annual Meeting will be convened at the Headquarters of The Institute in accordance with the By-Laws on

January 19th, 1928, at 8 p.m.

for the transaction of formal business and will be adjourned to reconvene on February 14th, as mentioned above.

The Headquarters of the reconvened meeting will be the Windsor Hotel

The details of the Programme will be announced in a subsequent issue of The Engineering Journal

THE

ENGINEERING JOURNAL

THE JOURNAL OF
THE ENGINEERING INSTITUTE
OF CANADA

DECEMBER, 1927 Volume X, No. 12

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THE

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The Institute as a body is not responsible either for the statements made or for the opinions expressed in the following pages.

Volume X — Montreal, December, 1927 — Number 12

The Montreal Tramways System

A Consideration of the Transportation Problem in Montreal from the Standpoint of the Operation of the Street Car System

J. F. Saint-Cyr,
Chairman of the Montreal Tramways Commission.

Paper read before the Montreal Branch of The Engineering Institute of Canada, November 19th, 1927

In 1892, that is, thirty-one years after the first appearance of tramways in Montreal, electric power was substituted for animal traction on the system. The change was by no means an easy matter. In fact, some of the shareholders were seized with panic at the idea that the company would attempt to operate wheeled carriages in winter. Laughable as we may find such a fear to-day, it did not differ from the reception given all those great inventions which have revolutionized the world in modern times. Even people who should know better will stick to routine, and it may be so for a long time to come. And yet, the world goes on.

In order to get better acquainted with the present tramways system of Montreal, we will in turn consider:—

(1) The basis and features of the contract with the city of Montreal.
(2) Its operation.
(3) The growth of Montreal and urgent civic improvements.
(4) The autobus service and rapid transit.

The Contract

In 1918, the economic crisis born of the war forced numerous tramways systems into insolvency. The originators of the Montreal contract thought they could prevent such a calamity in our case by adopting the cost-of-service system. Much has been said about public utilities during the last few years, but very few people really grasp the meaning of the term. In fact, the telephone, telegraph, electric and gas services, the railroads, the tramways, the water works, are not only utilities but absolute necessities. It therefore devolves upon public authorities to see to it that these services are so organized and maintained that the rates may be fair to the public while leaving a fair revenue to the operating companies. Other cities have municipalized the service. The public reports are available for your perusal, and the writer feels sure that once you have read them your conclusions will not be adverse to Montreal.

The following quotation is the opinion of Mr. Geo. B. Cortelyou, chairman, Joint Committee of National Utility Associations, in this respect:—

> "Despite the fact that the country as a whole has accepted and indorsed the policy of private ownership, operation and management of the utilities, ardent advocates of contrary policies appear from time to time with specious plans that would involve the government in vast expenditures, whereas every practical feature of their plans,—so far as they have any practical features,—could be secured, at infinitely less expense, by the normal extension and development of existing private agencies. They would have us believe that government can carry on the business better than those who have grown up in it and have made it what it is to-day, and this in spite of the wrecks that litter the road over which government operation had travelled in the past. Many of these enthusiastic theorists are less concerned with the success of their particular project than with gaining an entering wedge for their paternalistic ideas."

Nearly the whole of the revenue of the Montreal Tramways Company is derived from the passenger traffic. The

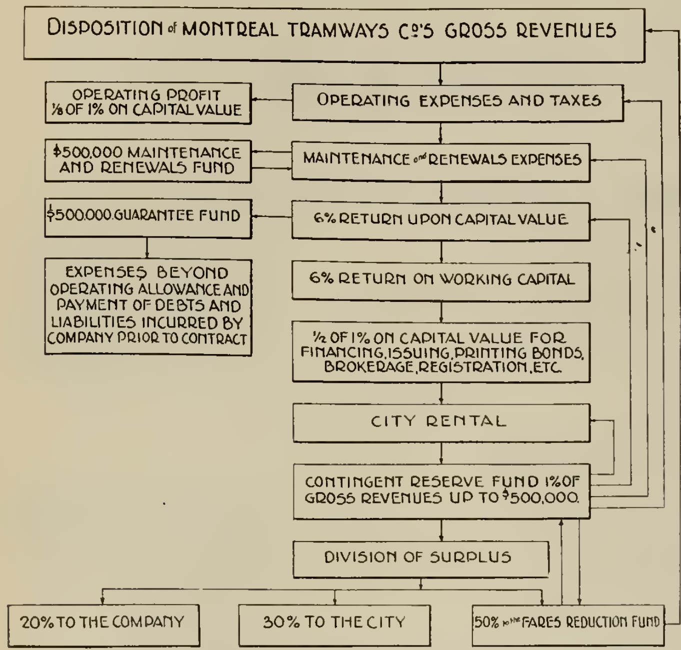

Figure No. 1.—Chart showing Disposition of Montreal Tramways Company's Gross Revenues in Accordance with Contract.

exact percentages from each source last year were as follows:—

Passengers	97.47 per cent
Freight	1.27 " "
Advertising and miscellaneous ...	1.26 " "

Out of that revenue, the following are paid, in the order named:—

(1) Operating expenses and taxes.
(2) Maintenance and renewals.
(3) Fixed charges.

The first two items chiefly consist of salaries and materials. The fixed charges include:—

(1) Return on capital value.
(2) City of Montreal rental.
(3) Contingent reserve fund.

The capital value of the system was first arrived at through an inventory, subsequent additions or extensions increasing the figures, while, on the other hand, items written off are deducted. On the total to date, the company is allowed a return of 6 per cent.

The city of Montreal is entitled to a fixed rental of $500,000 a year in addition to its ordinary taxes and other imposts. Its receipts in 1926 were as follows:—

Snow removal	$ 252,746.23
Taxes, licenses, etc.	322,897.92
Yearly rental	500,000.00
	$1,075,644.15

which is equivalent to $2,946.97 per day. The amount would be still larger were it made to include paving expenses borne by the company such as, in a great many other cities, are paid by the municipality. Then there is a contingent reserve fund of $500,000.

The surplus, if any, is divided as follows:—

20 per cent to the company.
30 per cent to the city.
50 per cent to the fares reduction fund.

Figure No. 1 will give a still better understanding of the contract.

Operation of the Contract

The city of Montreal and the company entered into an agreement which was afterwards ratified by the legislature. The commission, of which the writer has the honour to be the chairman, is intrusted with the execution of that contract. It prepares the budget, fixes the fares, supervises both works and service. Section 32 of the agreement also provides that,—

> ". . . in its operation, the company shall be on the look-out for all improvements and betterments relating to any part whatever of its system, both within and without the limits of the city, including its rolling stock, as may prove to be of recognized advantage, and it must adopt the same when so ordered by the commission and within the delay fixed by it."

The duties of the commission have been greatly facilitated by the efficiency and the goodwill of the company's management. There have arisen, and still arise, differences of opinion, but in such cases each party has a right of appeal to the law courts. The contract came into force on February 9th, 1918, and the commission was appointed at the end of April. Hardly had the Armistice been signed in November 1918, when the great economic crisis occurred. The commission at once realized the necessity of an increase in the fares, a step not such as to ingratiate it with the Montreal public. The remedy was applied. Now that it has been in use for nearly ten years, it may be interesting to compare the results with those achieved elsewhere through other means. Figure No. 2 shows the average fares in American cities of 50,000 or more population, as compared with Montreal. Since 1921 the average passenger fare in Montreal has been 6.04 cents. In the United States it is now 7.53 cents, with a tendency to rise still further. The citizens of Montreal have certainly no complaints to make for paying 24.06 per cent less. In spite of the lower fare, we were able to restore the financial position of the company when in other instances the position was barely improved. In this connection, table No. 1, which shows the trend of cash fares in the United States since 1923, is most interesting.

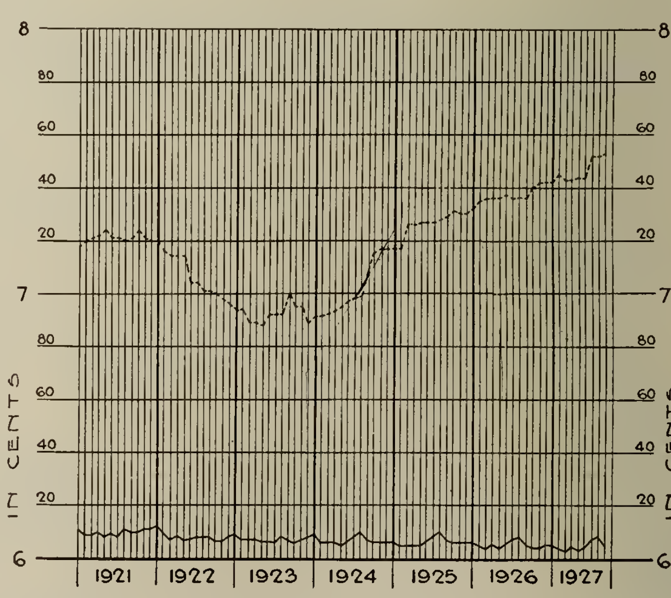

Figure No. 2.—Average Fares in American Cities of 50,000 or more Population Compared with Average Fares in Montreal.
(Upper curve (dotted)—average fares for American cities.)
(Lower curve—fares in Montreal.)

Table No. 1—Trend of Cash Fares in the United States Since 1923.

	All cities regardless of population	313 cities— Population 25,000 or over						
		Number of cities with cash rate of						
	10c.	10c.	9c.	8c.	7c.	6c.	5c.	3c.
August 31, 1927	214	110	1	54	70	24	53	1
December 31, 1923....	163	68	2	44	78	53	68	1
Increase or decrease since Dec. 31, 1923.	+ 51	+ 42	−1	+ 10	− 8	−29	−15	0

That result was made possible by economical management and well regulated service.

The goodwill of our employees also had something to do with it. Montreal is indebted to them for having been the only city without labour troubles after the war. True enough, the fares as well as the salaries had to be raised, but, thanks to the hearty and active co-operation of the employees, no enduring ill-feeling on the part of the public ensued. The creation of pension, sick benefit and death benefit funds last year was looked upon as a matter of justice by the company, and the commission was only too happy to assist in carrying out the scheme.

The following shows the Montreal fare to include:—

	Cents	Percentage
Salaries	2.74	45.29
Materials	1.06	17.52
Bond interest	.98	16.22
City of Montreal	.51	8.43
Maintenance	.30	4.95
Dividends	.19	3.14
Taxes	.05	0.83
Financing	.09	1.48
Surplus	.10	1.65
Contingent reserve	.03	0.49
	6.05	100.00

There is added to the revenue by freight traffic, advertising and the like the amount of 0.16 cent.

Table No. 2 is a comparative scale of wages in 1917 and 1926, in cents per hour.

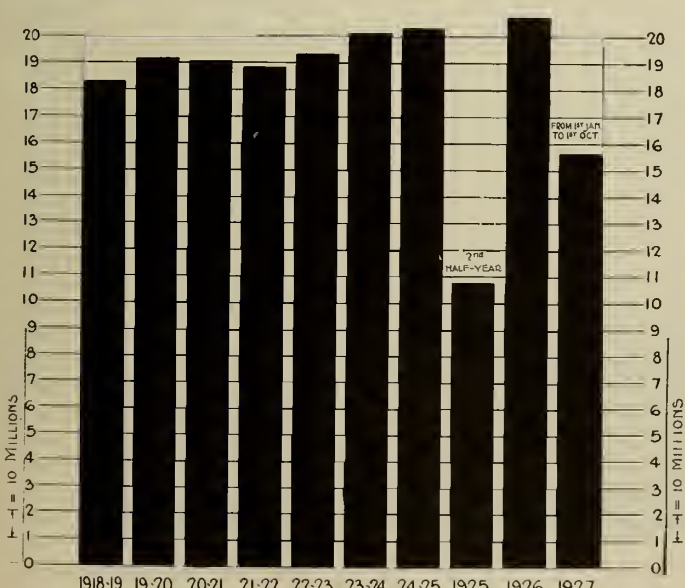

Figure No. 3.—Montreal Tramways—Revenue Passengers Carried During the Years 1918 to 1927.

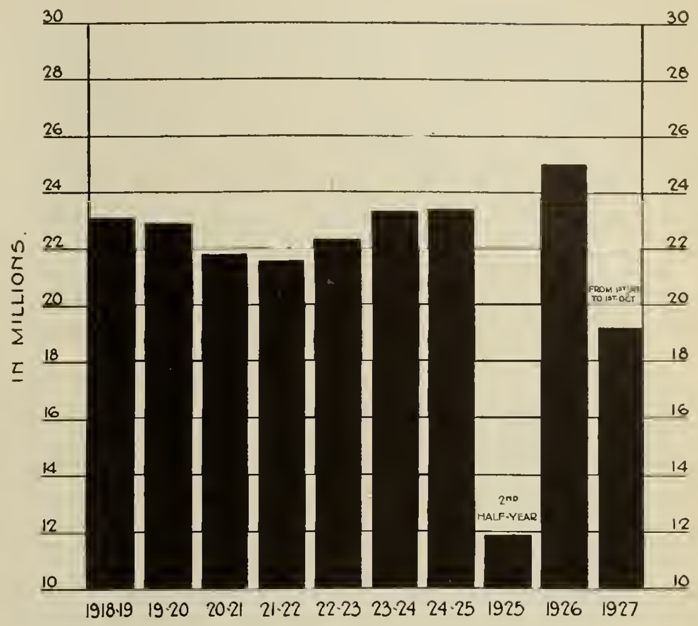

Figure No. 4.—Montreal Tramways—Car Miles During the Years 1918 to 1927.

Table No. 2.—Comparative Scale of Wages in 1917 and 1926.

	Cents per hour		Per cent increase
	1917	1926	
1st year	25	42½	70
2nd year	25	47	88
3rd year	26	51	96.15
4th year	26	51	96.15
5th year	26	51	96.15
after 5 years	29	51	75.86

The majority of the employees have a service record of fifteen years or more.

The difference in the price of materials in each of the two years mentioned is well known; in fact, electric power is the only item which has not increased; yet, the comparative figures given in table No. 3 show that the net earnings are lower to-day than they were ten years ago.

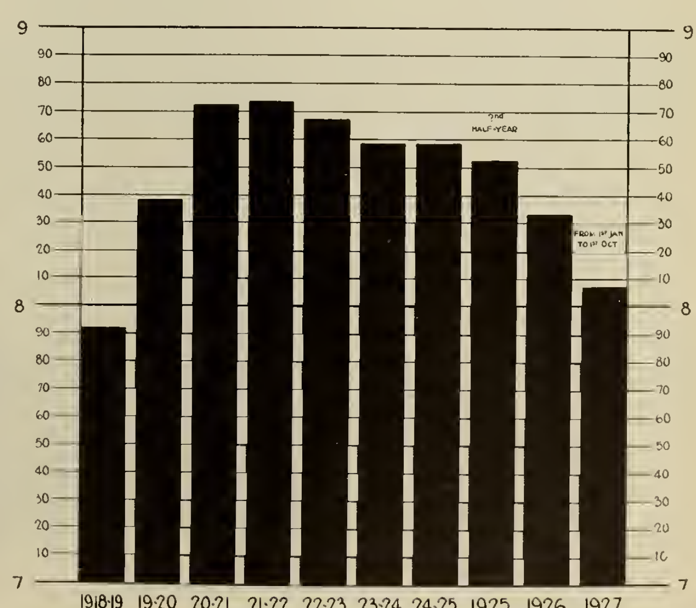

Figure No. 5.—Montreal Tramways—Traffic Density During the Years 1918 to 1927.

Table No. 3—Comparison of Receipts, Expenses and Earnings, in Cents, Per Revenue Passenger.

	1917	1926	Increase + Decrease — Per cent
Gross receipts	4.33	6.21	+ 43.41
Operating maintenance and renewal expenses	2.58	4.58	+ 77.51
Net earnings	1.75	1.63	— 6.86

The contract provides for traffic regulation by applying the rule of density, which itself is nothing else than the ratio between the number of passengers and the number of car-miles. The commission computes the density of traffic each year, and then, through a daily check, makes sure that the cars are operated on that basis.

The manner of finding out the traffic density is as follows:—the commission, in preparing the budget, fixes the sum per car-mile to which the company is entitled under the contract. Assuming the average fare to be 6.04, as mentioned above, the only thing required is to divide the amount allowed per car-mile by the amount of the fare. For instance, if the cost per car-mile is 50 cents and the fare is 5 cents, the density will be 10.

Now, the density of street car traffic cannot be raised even to 9 passengers per mile without great inconvenience

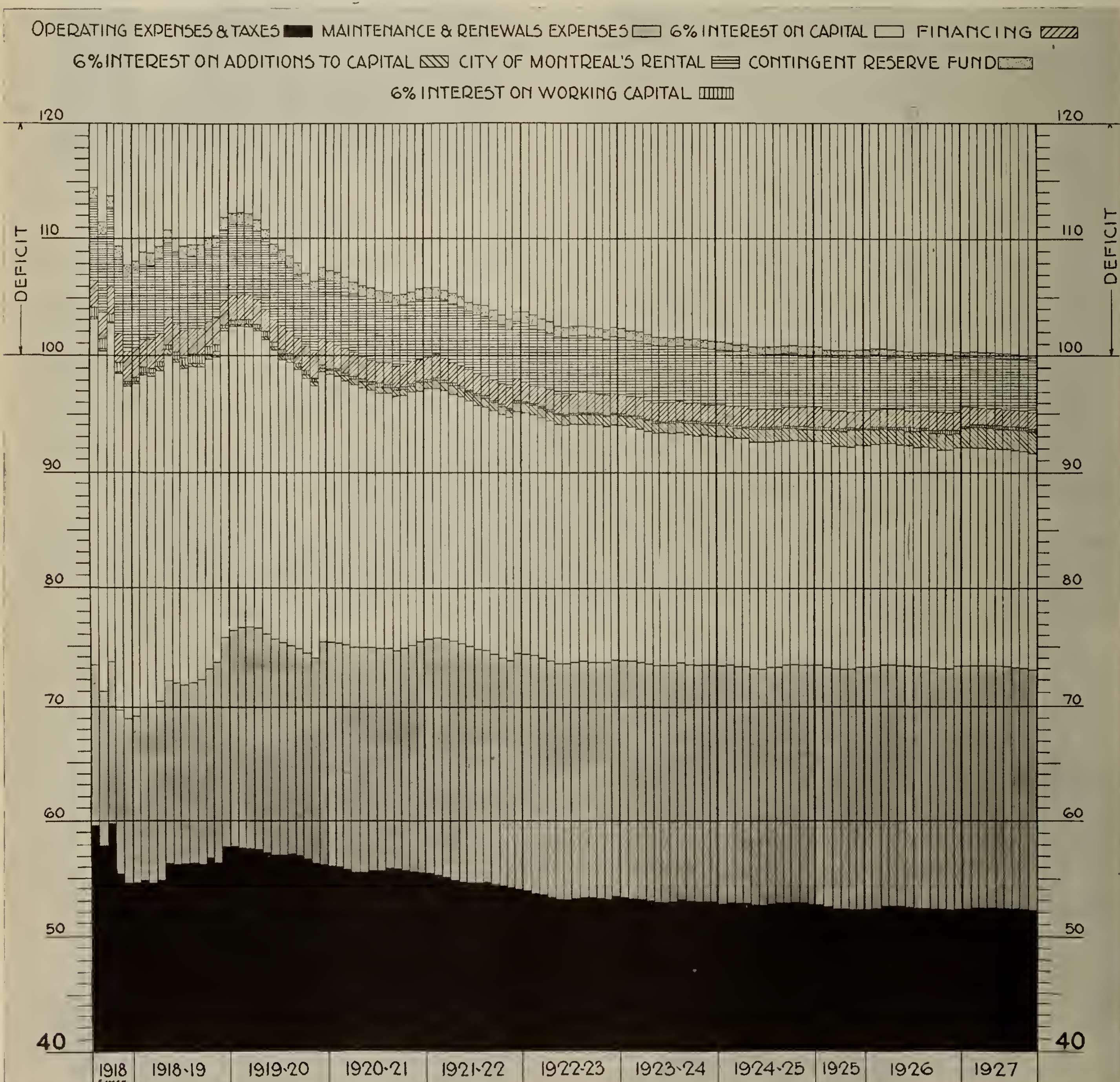

Figure No. 6.—Cumulative Distribution of Expenses Expressed in Percentages of Gross Receipts.

Table No. 4.—Comparative Traffic Statistics, 1910 and 1926.

	1910	1926	Per cent Increase + Decrease —
Total length of tracks (miles)	230.97	304.83	+ 31.97
Length of tracks in operation (miles)	209.93	284.36	+ 35.45
Gross receipts	$ 4,775,300.64	$ 12,899,602.31	+ 170.13
Revenue passengers	118,268,080.00	207,754,983.00	+ 75.66
Transfers	36,437,123.00	92,440,444.00	+ 153.69
Percentage of transfers to number of revenue passengers	30.81%	44.49%	+ 13.68 points
Car miles	16,000,000	24,934,224	+ 55.83
Total operating expenses	2,679,805.82	9,508,480.28	+ 254.81
Net receipts	2,095,494.82	3,391,122.03	+ 61.83
Gross receipts per revenue passenger, in cents	4.03	6.21	+ 54.09
Gross receipts per car-mile, in cents	29.8	51.73	+ 73.59
Percentage of gross receipts devoted to operating expenses and taxes	38.60%	51.46%	+ 12.86 "
Percentage of gross receipts devoted to maintenance and renewals	17.60%	22.25%	+ 4.65 "
Operating ratio (per cent)	56.2 %	73.71%	+ 17.51 "
Operating and maintenance expenses per car-mile, in cents	16.7	38.13	+ 128.32
Net earnings per car-mile, in cents	13.0	13.60	+ 4.61
Operating, maintenance and renewal expenses, in cents, per revenue passenger	2.27	4.58	+ 101.76
Net earnings, in cents, per revenue passenger	1.76	1.63	— 7.38

to the passengers resulting from crowding. This statement may look surprising at first. "How can that be," will be asked, "when the tramways are always full, and, instead of 9 passengers, it looks like 30, 40 or 50 to the mile?" An illustration is in order. Let us take, for instance, the St. Catherine street circuit, about 7 miles long. Under a density of 8.2, each car must carry at least 58 paying fares, transfers not included. Think of it! There are 40 to 42 seats to a car, and each car on the circuit must carry much more than that number of passengers, not only at rush hours, but morning, noon and night. The thing is possible on St. Catherine street, where passengers will come on and off, but conditions are quite different on the Cartierville line, where each passenger covers a very long distance.

Fifty-six tram lines, not to speak of autobuses, run through Montreal in all directions, giving a service of from 30 seconds to 15 minutes, according to the requirements of traffic. They are divided into three categories as to density, viz.:—21 good, (with density of 8.55 to 14.61), 20 medium, (with 5.24 to 8), and 15 bad, (with 2.84 to 4.80). In the management of tramways, as in all human affairs, the good must average with the bad; in other words, the good lines must make up for the losses caused by the unprofitable ones. The lower the fare the higher the density must be, or else the company will go bankrupt. Hence the fare increase which followed the war. To give a satisfactory service, sufficient revenue had to be found, and as the traffic density could not be raised the only possible remedy was to raise the fares.

The traffic density is an important factor from the two-fold standpoint of revenue and of service, as some lines with a limited number of fares may nevertheless carry a large number of transfers.

In Montreal, the financial deficits of the first years had to be wiped out by increasing the density without adding to the fare. Figures Nos. 3, 4, 5 and 6 illustrate the work of the commission in that respect. Having come out of the deficit era three years ago, we have since devoted all our efforts to the improvement of the service, and although much remains to be done we think the citizens of Montreal have reason to be satisfied with the result. This year our cars will cover 26,000,000 and our buses nearly 3,000,000 miles. As will be noticed from the diagrams mentioned above, if the number of passengers is divided by the number of miles for both the tramways and the autobus systems you get a density of 7.75, or over one point less than a few years ago, the object of the commission being to give the best possible service for the existing fare.

The introduction of the one-man car this year has had a marked effect. Although the public was not quite sympathetic at first, experience has shown the new type of car to have its good points. We have often been asked to introduce them on new circuits, and those requests had to be turned down for the lack of a sufficient number. The innovation was a fortunate one, as it enabled us to improve the service without necessitating a tariff increase. As explained, the company is paid by the car-mile, and the more we can lower the car-mile cost the more we can better the service without raising the fare.

Montreal's Growth and Urgent Improvements

Traffic moves abreast with the growth of a city, and as the tramway is still the great medium of transportation the progress of a city is better judged by reference to the tramways statistics. A comparison between the years 1910 and 1926 will show the progress of street car traffic in Montreal the last fifteen years. This is shown in table No. 4.

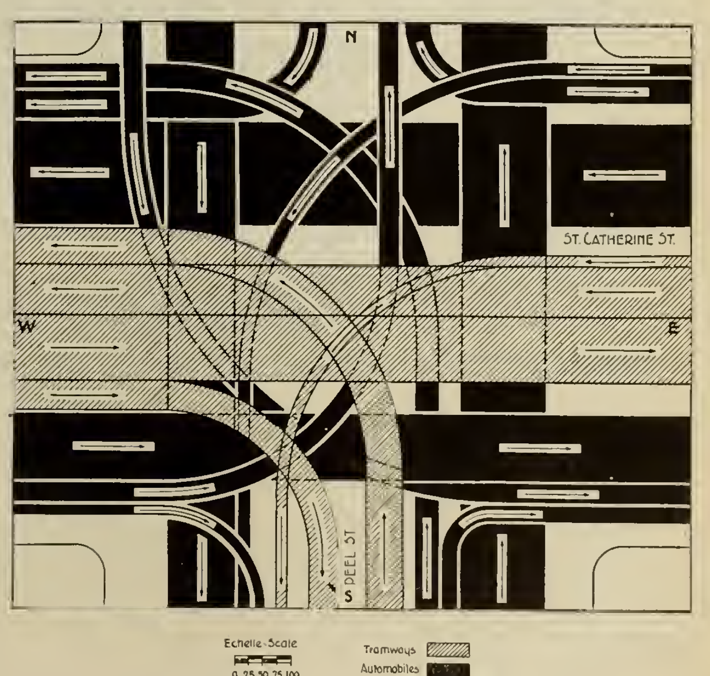

Figure No. 7.—Corner of Peel and St. Catherine Streets—Traffic Density and Movement of Tramways and other Vehicles between 5 and 6 p.m. on February 18th, 1925.

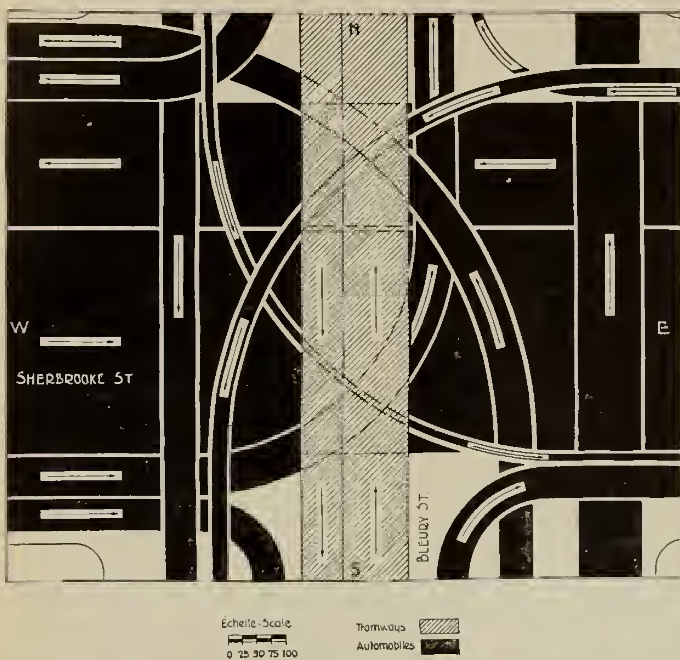

Figure No. 8.—Corner of Bleury (Park Avenue) and Sherbrooke Streets—Traffic Density and Movement of Tramways and other Vehicles between 5 and 6 p.m. on February 17th, 1925.

What reasons have we to think that this progress will come to an end? It is quite certain, on the contrary, that it will gain more impetus with years. It is therefore the duty of citizens of Montreal to favour any steps which will properly safeguard the future.

Figures Nos. 7, 8 and 9 will give some idea of the traffic going on in the streets of Montreal between five and six o'clock in the evening. They all relate to the state of congestion existing between five and six p.m. because this is the time of day when the service is most severely tested. The service is comparatively easy during the rest of the day, but things are different when we have to carry back to their homes in one hour's time all those working men and office people whose travel to their respective callings in the morning was spread over a period of three or four hours. In his anxiety to get home, nobody will consent to wait. Everybody will take the first tram that comes along, and congestion forcibly follows. How could it be otherwise?

Figure No. 7 shows the traffic density and the movement of tramways and other vehicles between five and six p.m. on February 18th, 1925, at the Peel and St. Catherine street crossing. It shows the following:—

Total number of tramways ...	201, being	29.64	per cent of total number of vehicles of all kinds.
Number of other vehicles	477, "	70.36	per cent of total number of vehicles of all kinds.
Number of tramway passengers	10,964, "	93.27	per cent of total number of people carried.
Number of people in other vehicles	792, "	6.73	per cent of total number of people carried.
Average number of passengers per tramway		54.54	
Average number of people in other vehicles		1.66	
Average number of tramway passengers per square foot of aera occupied		0.139	
Average number of people in other vehicles square foot of area occupied		0.139	
Coefficient of priority of public transport ..		22.06	

Figure No. 8 shows the traffic density and the movement of tramways and other vehicles between five and six o'clock p.m. on February 17th, 1925, at the Bleury, (Park avenue), and Sherbrooke street crossing, and gives the following:—

Total number of tramways ...	169, being	13.32	per cent of total number of vehicles of all kinds.
Number of other vehicles	1,099, "	86.68	per cent of total number of vehicles of all kinds.
Number of tramway passengers	9,192 "	81.19	per cent of total number of people carried.
Number of people in other vehicles	2,130 "	18.81	per cent of total number of people carried.
Average number of passengers per tramway		54.39	
Average number of people in other vehicles		1.93	
Average number of tramway passengers per square foot of area occupied		0.139	
Average number of people in other vehicles per square foot of area occupied		0.015	
Coefficient of priority of public transport ..		9.26	

Figure No. 9 shows the traffic density and the movement of tramways and other vehicles between five and six o'clock p.m. on January 27th, 1925, at the Bleury and St. Catherine street crossing, as follows:—

Total number of tramways ...	310, being	51.32	per cent of total number of vehicles of all kinds.
Number of other vehicles	294, "	48.68	per cent of total number of vehicles of all kinds.
Number of tramway passengers	19,153, "	97.6	per cent of total number of people carried.
Number of people in other vehicles	458, "	2.4	per cent of total number of people carried.
Average number of passengers per tramway		61.78	
Average number of people in other vehicles		1.55	
Average number of tramway passengers per square foot of area occupied		0.158	
Average number of people in other vehicles per square foot of area occupied		0.011	
Coefficient of priority of public transport ..		14.36	

Similar check-ups made in summer, (August 1925),

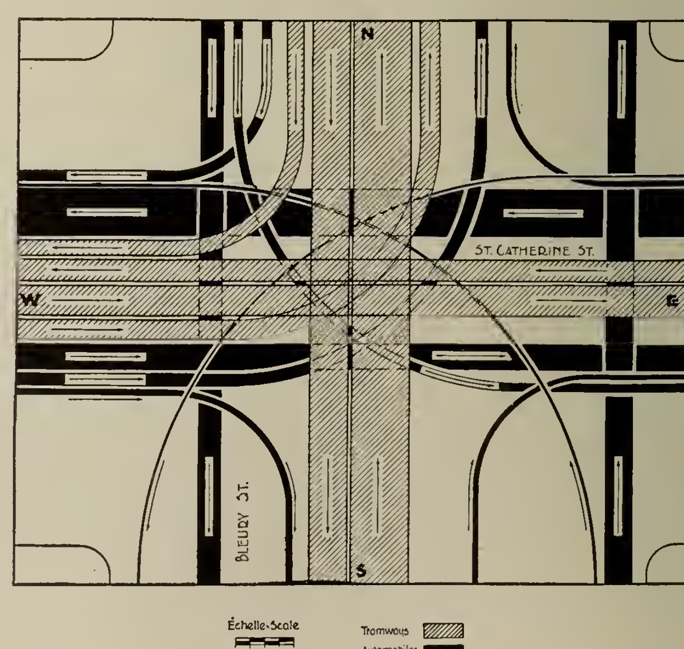

Figure No. 9.—Corner of Bleury and St. Catherine Streets—Traffic Density and Movement of Tramways and other Vehicles between 5 and 6 p.m. on January 27th, 1925.

show crowding to increase in proportion to the number of automobiles. For instance:—

At Peel and St. Catherine street crossing, the tramways form .... 21.07 per cent of the total number of vehicles.

and the tramway passengers form .... 85.7 per cent of the total number of people carried.

At Bleury and Sherbrooke street crossing, the tramways form .... 9.4 per cent of the total number of vehicles.

and the tramway passengers form .... 62.6 per cent of the total number of people carried.

At Bleury and St. Catherine street crossing, the tramways form .... 32.9 per cent of the total number of vehicles.

and the tramway passengers form .... 93.3 per cent of the total number of people carried.

These traffic counts were taken two years ago. The tramways service has increased materially since that time, and the number of automobile licenses in Montreal, which was 39,940 in 1925 has passed to 44,136 in 1926 and 48,192 in 1927. Another of these traffic counts is just being made, and undoubtedly the result will show that street congestion is worse than two years ago.

Table No. 5 shows the number of tramways in circulation in the business section of the city during the same hour. (See also figure No. 10.)

Table No. 5—Number of Tramways in Circulation Between 5 and 6 O'Clock P.M.

Place d'Armes East	127
Place d'Armes West	140
Terminus Station East	112
Terminus Station West	108
Bleury and Craig	336
Notre Dame and McGill	213
McGill and St. James	182
Bleury and St. Catherine	407
St. Lawrence and St. Catherine	192
St. Denis and St. Catherine	259
St. Denis and Craig	334
Notre Dame and Gosford	254

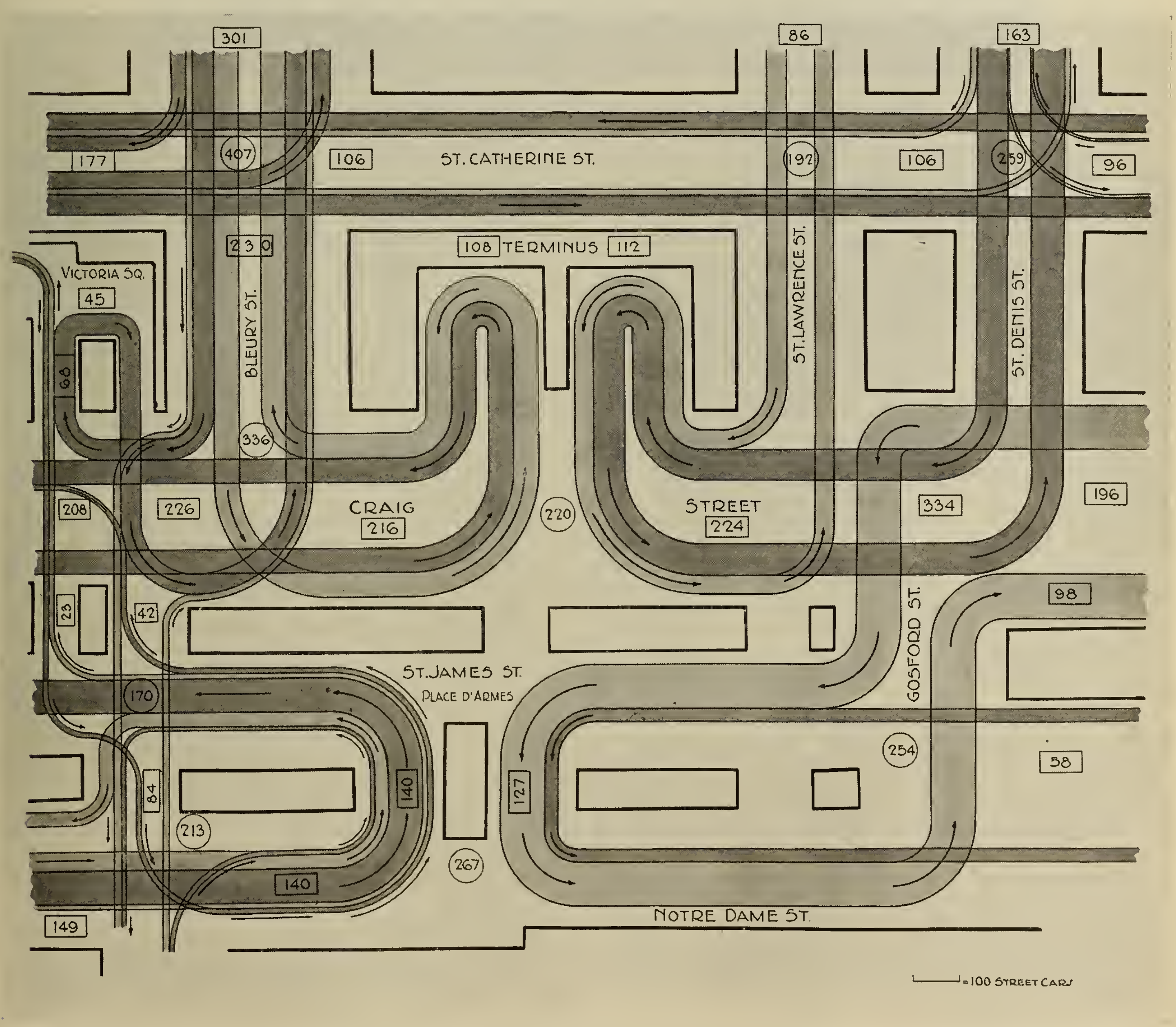

Figure No. 10.—Average Movement of Street Cars from Centre of Loop District During Rush Hour—5 to 6 p.m.

Figure No. 11.—View showing Congested Traffic of a London, England, Street.

Does it really look as if there was room for more cars? Those complaining of street car congestion forget that they themselves are partly responsible for it, as the company does not compel them to take any particular car, and it could be shown that traffic congestion would be materially relieved if everybody would have a little more patience.

In all great urban centres, speed is one of the essential elements of the traffic problem. What matters is not so much the distance from one's home to one's place of business as the time it will take to go from one's home to one's business. Indeed, if you can travel two miles in five minutes, you do not live farther than a five-minutes' walk. This is but another proof of the saying, "Time is money."

In Montreal, the company and the commission are doing their best to speed up the surface tramways. Our first step was to cut out a certain number of stops. The service could be further improved by a more general application of that policy, but you cannot imagine all the protests which the suppression of the most useless of stops will arouse. While everybody wants greater speed, everybody balks at the idea of walking one hundred yards to board the tram. The hardest thing to secure in this matter is the goodwill of the people who would benefit by the change. Under such conditions, the officials in charge cannot but bear up patiently until the need of a change is universally admitted.

The building of the Craig street terminal station has enabled us to increase the speed of tramways at hours of the greatest density. Up to three years ago, every morning and evening on Craig street, from Victoria square to Champ de Mars, one could witness a long chain of vehicles bumping and jostling one another and all of them moving at an average speed of four miles an hour. To-day there is hardly any crowding and the Craig street tramways, especially the eastbound ones, start off promptly. Other construction of the same nature is needed, but nothing worth while can be done without the co-operation of the public.

The following is quoted from a newspaper article recently published by the Westinghouse Company in the form of an advertisement:—

"Cities have a traffic problem largely because the street-users have outgrown the street space. Roadways built in 1890 are not an inch wider to-day, and modern traffic leaves them sadly unable to carry their load. Cities grow larger, but streets only grow older,—and congested traffic is the certain result.

"Indeed, traffic could hardly move at all if so much of it did not move through the space given over to car tracks. In large cities, 75 per cent of all the street-users are transported by street cars. A street car occupying 400 square feet of roadway can carry 100 passengers,—each passenger occupying four square feet of the street area. There is no other transportation method by which anywhere near 100 people can be carried in anything like 400 square feet of roadway. That is why the car tracks are the backbone of the traffic system.

"Occupying only 2 per cent of the street space, but carrying 75 per cent of the street-users, the street cars prevent slow motion from becoming no motion. So keep an open mind toward the street car company. On it depends the movement of a city's life."

The trouble with Montreal,—particularly the business section,—is the same as with all of the older cities. The streets are too narrow for modern traffic. Great arteries should be opened and the parking of automobiles in the business district prohibited. Not thinking of possible consequences, the city authorities have gradually allowed the automobile owners to turn into garages the streets originally and rightly intended for traffic.

The growth of the city is in itself a cause of congestion, and if the streets no longer serve the purpose for which they were laid out there can only be one outcome. All of the other large cities have been forced to apply radical remedies. Montreal has certainly done something, but a tremendous lot remains to be done. It is only fair to add that the municipal authorities are fully conscious of the situation and have set to work to find a remedy.

So much for the older districts. As to the new districts, a general plan of the city is required at once. Otherwise, almost insoluble problems will keep piling up and additional delay will only mean additional expense.

Speed has an all-important bearing on tramways fares. As already pointed out, the company is entitled to a given return per car-mile, but, as the bulk of its expenditure is reckoned by the hour, it follows that the cost per car-mile is largely in proportion to the number of miles covered per hour.

Autobus Service and Rapid Transit

For a couple of years, the company has been operating autobuses. This step is viewed by some as a solution of the problem of urban transport. This is a mistake, for all experts agree that the autobus cannot be more than an auxiliary to the tramway. It takes three to four autobuses to do the work of one tramcar, and each of them fills a space out of proportion with its carrying capacity.

Let us compare statistics for the first ten months of this year in this respect:—

	Miles	Passengers
Tramways...........	21,489,094	174,444,672
Autobuses...........	2,341,067	8,640,013

During that period, the tramways covered 21,489,094 car-miles and the autobuses carried 8,640,013 passengers. In other words, the number of autobus passengers was only equal to 0.402 for each car-mile covered by the tramways. In view of those figures, do you think that this additional service proved a material relief?

True enough, it may be said, but you could no doubt relieve congestion by using more autobuses. Figure No. 11 is a photographic view of a London street, and, after looking at it, is it still possible to believe that street crowding can be cured in that manner? Those who have been in New York know the same conditions exist there. A recent article of the *New York Tribune* on the subject says:—

> "To carry 2,000,000 passengers a day in rush hours,—and this demand will soon come,—would require a fleet of 100,000. Where would they park? In single file, with 20 foot headway, they would stretch out 400 miles. Four abreast, the procession would be 100 miles long. To get road room, it would be necessary to spend several hundred millions on new streets and avenues."

Commenting on the same subject, Major F. D. Burpee, AFFILIATE E.I.C., general manager of the Ottawa Electric Company, expresses himself as follows:—

> "Of all vehicles, the street car is the most economical user of street space. It is always on the move. It never parks. Moreover, it is the safest vehicle. The very fact that it is running on rails makes for safety. You know which way it is going and can co-ordinate your own movements accordingly."

Does the surface tramway meet all the requirements of a large city as a means of transport? We ourselves do not think so. Indeed, the speedy carrying of a large population cannot be achieved without the adoption of other features, such as:—

(1) Stations where passengers can board or leave the tramways expeditiously.
(2) Pre-payment of the fare.
(3) A free right-of-way.
(4) As few stops as possible.

Elevated lines or subways can alone embody those features, and subways should be built preferably when possible. Howsoever convenient for the time being, elevated lines in our case would only afford temporary relief instead of the permanent solution which Montreal owes it to itself to seek.

There are several systems of subway construction and operation. For instance:—

(1) The city may build the subway at its own expense and lease it to a company on given conditions. This was done in Paris.
(2) The city may subsidize the construction of the system on the condition that it will share in earnings. This was done in New York.
(3) The city estimates the expense that can be borne by the system and causes the remainder, if any, to be paid out of general or special taxes. This is proposed in Detroit.

Moderate subway fares cannot be had unless the public shares in the expense some way, for it is quite evident that otherwise a subway costing about five million dollars per mile could not be operated. In view of the benefits to accrue to the public, no municipality in need of a subway has refused to share in its construction or maintenance.

The opportunity to place that question before the citizens of Montreal will come shortly. Let us hope that all parties interested in the future welfare of the city will help us to arrive at a solution which will not only keep Montreal in the lead of Canadian cities, but will also enable it to outdistance its rivals in the United States and elsewhere.

The St. Lawrence River Power

The Possibility of Developing this Power Prior to the Proposed Deep Waterways Scheme but in Harmony with what Ultimately May be Required for Water Transportation

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Paper read before the Niagara Peninsula Branch of The Engineering Institute of Canada, October 28th, 1927

The development of power on the St. Lawrence river is intimately related to the problem of artificial regulation of the Great Lakes, and to the general problem of a deep waterway to the sea. While the following discussion will attempt to prove that power development can temporarily stand by itself as an actually consummated scheme, its basic conception must be in full harmony with what the future may require in the matter of water transportation, and in connection with the complete or partial artificial regulation of the Great Lakes system and its connecting waterways.

The one factor which forms an unchangeable background for any discussion of the deep waterways scheme, as now proposed, is a purely physical one, and one which separates the project into two absolutely distinct phases. This factor exists because the St. Lawrence river, between lake Ontario and lake St. Francis, is an international stream, where international co-operation is therefore obligatory under the law, while, on the other hand, between lake St. Francis and the city of Quebec it lies wholly in Canada, so that international co-operation on this reach of the river is purely a matter of expediency, and one which lies wholly within the discretion of the people of Canada as to the nature and extent of any international co-operation which may be invited or considered. It follows that the practical consummation of the deep waterways scheme, as now conceived, will depend wholly upon a mutually satisfactory agreement between the two countries as related to these two distinct phases of the problem, and the possibility of reaching any such agreement will naturally depend upon the extent to which the two countries have an immediate and common interest in the anticipated results.

Interest in Scheme Varies in Different Sections of Both Countries

The organized agitation for the deep waterways scheme had its inception in the mid-western states immediately after the war, when the rail transportation system of the United States broke down to the extent of not being able to absorb the traffic offering between the Mississippi valley and the Atlantic seaboard. Therefore, inasmuch as the people of these states seized upon the development of the St. Lawrence waterway as a specific means of relieving congestion on their rail systems, they were primarily interested in the transportation phase of the deep waterways scheme and they were not interested in the power.

Meanwhile, in New York and others of the eastern states, the transportation phase of the project has been bitterly opposed, not only upon competitive, but on economic grounds. In support of this latter contention, it is pointed out that New York state has spent one hundred and twenty million dollars on the enlargement of the Erie canal, only to find that traffic tonnage on the enlarged waterway is said to have dropped to about one-fifth of that previously carried by the old Erie canal. On the other hand, New York state is deeply interested in St. Lawrence power. Years ago the New York State Public Service Commission stated that " the demand for more power in western New York is insistent, and is being urged with great force." This need has since spread far beyond the range of any contemporary increase in supply, and now embraces all of New York, Pennsylvania and New England.

Therefore, as regards the attitude of the United States toward the deep waterways scheme as a whole, we have the Mississippi valley hungry for its transportation facilities, but passive as regards the power, while at the same time we have New York, Pennsylvania and New England hungry for its power, but either passive, or in bitter opposition, as regards the transportation phase.

Considering next the Canadian interests, it is at once evident that the middle west is very far from having any such condition as an inadequate rail transportation system to stir its interest in the deep waterways scheme. As a matter of fact, the west is not interested in additional transportation facilities, but in lower transportation costs, and the continuous and sustained agitation for the opening of the Hudson Bay route clearly indicates that the middle west believes, whether rightly or otherwise, that its best interests lie in this direction rather than in the incurring of the vastly heavier financial commitments involved in the deep waterways scheme. Now that the federal government of Canada has practically committed itself to the construction of the Hudson Bay railway and harbour terminals, it is doubtful if the middle west will even maintain the comparatively mild interest it has previously manifested in the larger project. Furthermore, it has no direct interest in power development on the St. Lawrence river.

The province of Ontario stands to profit by any increase in water-borne traffic on the Great Lakes, and it is therefore interested in the transportation phase of the scheme, but her main interest is now and always in the power development possibilities. The contract recently entered into for the supply of power from Quebec to Ontario will possibly meet the normal increase in load for the next four years, but some large additional source of power must then be made available if the needs of the latter province are to be satisfied.

There has been no organized opposition to the scheme on the part of the province of Quebec, but rather an attitude of indifference, which is apparently due to uncertainty as to whether the transportation phase of the project will or will not be inimical to the interests of the port of Montreal. Beyond this also is the overshadowing issue involved in the proposition of allowing the United States to share equally in the cost, and presumably also, in the benefits resulting from the development of the deep waterway scheme, not only on the international portion of the St. Lawrence river, but on that portion of the river which lies wholly within the province of Quebec.

Factors Involved in Purely Physical Conception of the Scheme

Six years have elapsed since the International Joint Commission reported that the St. Lawrence deep waterways project was physically feasible, and set the seal of its approval on the scheme as a whole and in general terms. Nevertheless, largely by reason of the wide range of interests which the scheme embraces in its present form, we find it even yet involved in a maze of uncertainties, indifferences and conflicting interests, not only as between the two countries themselves, but between various states on one side of the boundary and various provinces on the other.

It is not necessary, for the purpose of what follows, to predict what the final outcome of this situation may be, but simply to call attention to the fact that the only feature of the scheme in connection with which there is any unanimity, or any community of interest, is the development of hydro-electric power in the international reach of the St. Lawrence river. There is here a definite point of contact between Canada and the United States through the agency of the common need of the province of Ontario, on the one hand, and the state of New York on the other, as related to an augmented power supply.

The question then arises as to whether this need can be satisfied under international auspices, and whether the establishment of this initial point of contact can be made to serve later as an agency to bring about the consummation of the project as a whole. Before this aspect of the situation can be intelligently discussed, it will be necessary to consider the factors involved in the purely physical conception of any power development scheme on the international reach of the St. Lawrence river.

In the first place, the question of available water supply involves the matter of artificial regulation of the Great Lakes. It is a well established proposition, for the demonstration of which there is not time or space now available, that any scheme for the artificial regulation of the Great Lakes must progress upwards and not downwards. In other words, lake Ontario must be artificially controlled before any artificial regulation whatever can be put into effect at the outlet of lake Erie. On the other hand, the interposition of Niagara falls makes it possible to artificially regulate lake Ontario without in any way affecting the rest of the Great Lakes system, so that the artificial regulation of lake Ontario *alone* may be considered as an available agency for improving the flow conditions of the St. Lawrence river. This statement applies to the river as a whole, including the ship channel below Montreal, so that the advantage to power development arising out of the artificial regulation of lake Ontario will be similarly effective as related to deep water navigation facilities.

The matter of head concentration must be considered in its relationship to the combination of such factors as property damage, construction and operating hazards, effective power capacity, and ultimate production cost.

It is physically feasible to concentrate all of the available head in the international reach of the river at the foot of the Long Sault rapids, in the vicinity of the town of Cornwall. It is also physically feasible to develop the available head in two stages, involving one concentration at the foot of the Long Sault and a second concentration below the Rapide Plat, near the town of Morrisburg.

As between these two alternatives, the two stage scheme is the more advantageous. It is more in harmony with the natural gradient of the river and therefore tends to minimize the very serious item of property damage associated with the single stage scheme. It also makes available a maximum of effective head, and would make power available for commercial service about three years earlier than would be the case if all the power were developed in a single stage. Furthermore, the product of the upper development, being comparatively small in quantity, would soon be disposed of and producing revenue, whereas the much greater quantity of power to be provided for in connection with the permanent works and initial power installation of the single stage development would cause an enormous suspense charge to accumulate against the capital investment before transmission systems could be built and sufficient power sold and used to enable the project to pay its way.

Assuming that the hazards associated with the structural features of the single stage development need not be considered, the outstanding operating hazard is that which exists by reason of different types of ice formation.

In the Niagara river, the ice hazard is for the most part due to broken field ice from lake Erie. This ice is driven into the unprotected outlet of the lake at Buffalo under the influence of down-lake winds, and passes down the river and over the falls in immense quantities. No such condition exists on the St. Lawrence river because the frozen labyrinth of the Thousand Islands effectively prevents any lake Ontario ice from entering the river proper until after the spring break-up, at which time it does not constitute a serious menace, and protective measures alone are sufficient to offset this and such additional hazard as may exist by reason of any field ice forming in the channel of the river itself under regulated conditions, and which might break free from time to time.

In connection with the other types of ice formation, frazil and anchor ice, which constitute the principal hazard on the St. Lawrence river under existing conditions, there is reason to believe that preventative as well as protective measures can be made effective in reducing the operating hazard.

In this connection, Dr. Howard T. Barnes, M.E.I.C., of McGill University, recently delivered a lecture in Toronto, in the course of which he explained the accepted theory relating to the nature and formation of ice. This theory is briefly to the effect that ice is always present in water at any temperature in the form of a complex molecule. These tri-hydrol molecules, as they are called, are continually in suspension in the fluid, and when the temperature of the fluid is at or below freezing point they coagulate in the form of the visible surface layer which is ordinary ice. Another peculiar property of these tri-hydrol molecules is that if still water at a temperature slightly below freezing point is agitated or subjected to shock, they become visible instantaneously in the form of a loosely constituted mass suspended throughout the body of the fluid. Such an agglomeration of tri-hydrol molecules is what is called "frazil."

Furthermore, if a foreign body is introduced into the fluid when it is at this critical temperature, the tri-hydrol molecules will anchor themselves to it in the form of a visible ice layer. When this formation takes place on the rough bottom of a river, it is known as "anchor ice." Both of these manifestations occur or disappear, as the case may be, under the influence of exceedingly small temperature variations.

This fact is of great importance as related to certain conditions revealed in the course of Dr. Barnes' water temperature studies on the St. Lawrence river. He found that the water temperature of lake Ontario at Kingston does not reach freezing point until February, but that the outflowing water is sufficiently chilled in the shallow reaches of the St. Lawrence river to reduce its temperature to freezing point in the vicinity of lake St. Francis in the early part of January and near Montreal about the middle of December. When this chilling effect has induced the necessary critical temperature, anchor ice forms in the bed of the river, and the shock and agitation incidental to the passage of the water over the various shoals and rapids between lake Ontario and lake St. Francis also causes large quantities of frazil to form. Inasmuch as the causes of these manifestations are known, it is well worth while to enquire whether preventative as well as merely protective measures can be made effective in reducing the operating hazard thereby created.

The proposed developments on the international portion of the river will transform it into two pooled reaches, the lower extending from the foot of the Long Sault rapids to Morrisburg and the upper from the vicinity of Morrisburg to the head of the river, the dam at Morrisburg thus constituting the artificial regulating agency for lake Ontario. The natural fall of the river from lake Ontario to the foot of the Long Sault is about 90 feet, but when the two developments are in operation the gradient from lake Ontario to the upper development and the gradient in the lower pool between Morrisburg and the Long Sault will not ordinarily exceed 8 feet in all, the balance of 82 feet constituting the total effective head concentration. In other words, the ice forming rapids and shoals in the international reach will be eliminated and the augmented depth of flow will carry lake Ontario water a much greater distance than under present natural conditions before it drops to the critical temperature at which frazil and anchor ice will form. This means that the head concentrations which are primarily necessary for the production of power will incidentally constitute a preventative agency against the formation of frazil and anchor ice.

One other fundamental consideration, from the purely engineering standpoint, remains to be discussed, having to do with the use of water.

The artificial control of lake Ontario will necessarily be exercised under international auspices and through an agency paramount to the power developing interests. This agency will control the flow in the general public interest, and need not necessarily be concerned as to whether the flow so maintained passes through the wheels or is wasted over the spillways. It therefore devolves upon the developing interests to fix for themselves the economic limit of installed capacity.

Under one of many feasible schemes of flow control, the minimum regulated flow would be 200,000 second-feet and the maximum 280,000 second-feet. Under 82 feet of effective head, this would mean about 1,700,000 horse power of prime power and an extreme maximum of 2,300,000 horse power on the international reach of the St. Lawrence river. In the sixty-year period of record up to 1921 there would have been available 1,700,000 horse power for sixty years; 1,800,000 horse power for forty-eight years; 1,900,000 horse power for thirty-eight years; 1,950,000 horse power for thirty years; and 2,000,000 horse power for eighteen years. In other words, it may be expected that under an 82-foot effective head the international reach of the river will yield about 2,000,000 horse power for half the time and 1,700,000 horse power all the time. This margin of 300,000 horse power of secondary power would be available not only over intermittent periods of days, weeks or months, as in an ordinary river, but often over a period of successive years, and during the sixty-year period of record these increments of secondary power alone would have amounted to over 10,000,000 horse power years, or the fuel equivalent of about 80,000,000 tons of coal.

Furthermore, inasmuch as the now installed steam-electric capacity in New York, Pennsylvania and New England is greatly in excess of the total amount of power available in the international reach of the St. Lawrence river, there would be a ready market for this secondary power. Such being the case, the ultimate wheel installation can properly be fixed on the basis of not less than 2,000,000 horse power of ready-to-serve capacity.

The purely physical or engineering conception therefore involves the artificial regulation of lake Ontario, the application of preventative as well as protective measures in connection with the ice problem, the construction of two power developments operating under a total effective head of 82 feet and designed to accommodate a wheel installation of not less than 2,000,000 horse power.

The Incorporation of the Power Development in the General Deep Waterways Scheme

We are now able to discuss the key question as to whether the various elements of the above conception can be so designed, placed and operated as to enable them to be effectively incorporated in the ultimate deep waterways scheme at any future time, and whether, such being the case, the initial step of the project, having to do with power development alone, can properly be undertaken under international auspices.

In the first place, the regulation of lake Ontario is a perfectly logical, if not essential, element of the navigation phase of the scheme, and the assumption of paramount international control assures a harmonious relationship between the power and navigation phases, insofar as artificial regulation is concerned.

As to head concentration, the pooled reaches can be adapted at any time, now or in the future, for any depth of navigation up to the contemplated 30 feet. Finally, the development plans, as approved by constituted authority, will include provision for lockage facilities similar to those now being provided for on the Welland ship canal. The locks need not necessarily be built coincidently with the power development works, and they can subsequently be designed for any depth on the sill that future conditions may indicate as being proper, up to the ship canal limit of 30 feet.

Having arrived at this point, the question as to whether the power development scheme *per se* can be proceeded with under international auspices is susceptible of a brief and definite answer. When the developing interests on each side of the boundary have agreed upon a common basis of policy and procedure, the necessary licenses and other instruments of formal authority to proceed with the work could issue from both Canada and the United States under the law as it now stands.

The picture has therefore been drawn up to this point. The power development of the international reach has been completed, and lake Ontario and the St. Lawrence river are regulated under international authority. The pooled reaches and the dams at Morrisburg and the Long Sault stand ready to be adapted for navigation to any depth up to 30 feet at any time, now or hereafter. In other words, the development of the power project on the international reach of the river would carry with it immediately available provision for the establishment of deep waterway navigation as far as lake St. Francis. Under such conditions, there would be considerable latitude with regard to subsequent procedure. Such dredging as might be necessary in the reaches could be done jointly by the two countries or by either one of them separately, as their respective needs might from time to time require. Similarly, the lockage facilities could be provided jointly or separately for any depth which might be considered in harmony with the then existing conception of what the requirements of navigation might be.

It appears to be the consensus of informed engineering opinion that the deep waterways project between lake St. Francis and Montreal must take the form of lateral canals, instead of the canalization of the main stream. For this reason, and for the additional reason that this portion of the waterway will be wholly within the province of Quebec, the United States would have no share or interest in the power. The question therefore arises as to whether or not, with the power element eliminated, there are economic forces now prevailing of sufficient magnitude to effect the consummation of the deep waterways project between lake St. Francis and Montreal.

The Transportation Situation in Canada Relative to the Proposed Waterways Scheme

The mid-western states want the waterway immediately and other sections of the United States do not want it at all, some because they fear it as a competitor and some because they are certain it will be an economic failure. As to Canada, it is entirely obvious that the deep waterway is not required to bolster up an inadequate railway system, nor is it immediately required to increase water transportation facilities, as the carrying capacity of the St. Lawrence canals is by no means exhausted, although they have not been enlarged for about thirty years. At the same time, freight traffic on the Canadian railways is rapidly increasing, a condition which would appear to indicate that rail transportation is gaining in popularity over the older and slower methods of transportation by water.

Therefore, leaving out of account altogether an apparent lack of unanimity on the part of United States sentiment towards this project, the question arises as to whether Canada needs, or can afford, to incur the expense of the St. Lawrence deep waterway scheme at the present time. If she ever does need it, either in the near or the remote future, the fact of her needing it will carry with it the reasonable assumption that she could at least afford to build the lake St. Francis-Montreal section of it herself, when the time comes.

It would also seem that before making a final decision in respect of this particular phase of the project, Canada might well consider the construction of the deep waterway as far as lake St. Francis only, under the international authority which would naturally function in respect of that portion of the project, and thereafter the establishment of a bulk-breaking point connected to Montreal by a specially designed railway operated by upper St. Lawrence power. Specially designed ore-boats furnish the cheapest water transportation in the world on the upper lakes, and it might be well worth while to ascertain whether or not a wide gauge railway, with specially designed cars and electric locomotives, would furnish the cheapest rail transportation in the world between lake St. Francis and Montreal. The grades at least are favourable, and, as by far the greatest bulk to be moved would be coal and grain, specially designed transportation facilities might prove to be more economical than an ail-water route, even with re-handling charges considered.

It is, of course, evident that the above argument is without weight if the power project itself is not commercially feasible. In other words, the power must be profitably disposed of after it is developed, and large quantities of power must be sold very soon after the upper stage development is completed in order to obviate the compounding of the heavy capital charges which must inevitably be associated with the scheme.

The Disposition of the Power Developed

This phase of the argument involves the basic assumption that in the early years of operation the power must be sold wherever the waiting market exists, independent of the international boundary. This assumption is necessary because of the fact that the bulk of the waiting market is south of the boundary at the present time, and, while Canada may not have serious difficulty in absorbing her share of the product of the upper stage development within a reasonably short period subsequent to its completion, the same condition may not hold with reference to the larger development at the Long Sault, and, if the power development project as a whole is to be maintained on a commercial basis, some portion of Canada's share of the power *must* be initially marketed in the United States.

If, for instance, the municipalities of the province of Ontario were to ally themselves, through the instrumentality of their Hydro-Electric Power Commission, with a public utility interest in the United States for the purpose of jointly developing the power on the international reach, the contract agreement between the two parties should provide for the initial sale of Canadian power in the United States definitely subject to reclamation on appropriate notice, as and when the Canadian market might be in a position to absorb it. Any notice given for the reclamation, under this contract, of any predetermined amount of power would require to be sufficiently in advance of the actual taking to allow the United States interests to replace it by a like quantity of power, through the installation of additional capacity on the St. Lawrence, or by the development of inland water power resources, or by the provision of additional steam-electric capacity.

There is nothing in this proposal which is in any way at variance with the stand taken by the provinces of Ontario and Quebec in the matter of the export of hydro-electric power under firm long term contracts or with the existing Canadian law having to do with the export of electricity.

It is nothing more than a perfectly feasible expedient designed to give the St. Lawrence development project the status of a commercial enterprise, to the mutual interest and advantage of both countries.

Finally, it may be contended that the argument as a whole is fallacious, in that it leaves the deep waterways project in the air, so to speak, when it has progressed as far as lake St. Francis, and that it is absurd to suggest that the project be carried thus far and no farther. As a matter of fact, no such suggestion is directly involved in this discussion, because the argument is directed wholly toward the apparent feasibility of proceeding with the development of power on the international reach of the St. Lawrence river in such a way that it may not only be regarded as a self-contained power project but also as the initial stage of an ultimate deep waterways project that may be carried out at any time in the future under such auspices and in such manner as may finally be agreed upon by Canada and the United States. In other words, an effort has been made to prove that, as related to the initial power development phase, the deep waterways scheme can be carried out as a whole, either coincidently with the power development or ten or fifty years later, or step by step, in harmony with the growth of common need and effective co-operative impulse on the part of both countries.

The point to be stressed here is that the common need and co-operative impulse are in full force at the present time with regard to power development, and it would be well to take heed to it in the practical and tangible way it has been the purpose of this argument to indicate.

The Manufacture of Sulphite Pulp

Historical Notes and a General Review of the Process of Manufacture and Extent of the Industry

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Paper read before the Victoria Branch of The Engineering Institute of Canada, December 16th, 1926

The manufacture of sulphite pulp dates back to 1866. An American chemist, Mr. B. C. Tilghman, obtained in England a patent on a process for cooking wood with a solution of sulphurous acid with or without the addition of calcium bisulphite. His experiments were carried out in Pnanayunk, near Philadelphia, and were not a commercial success. A Swedish chemist, Mr. C. D. Ekman, developed the process to a commercial success using indirect cooking, that is, steam was not in direct contact with the acid and chips, and started the first sulphite mill in Bugvik, Sweden, in 1874.

About 1878, in Austria, Eugene Ritter and Carl Killner developed a sulphite process in their mills and kept the process a trade secret, but patented their method of cooking in 1882. Steam was admitted directly to the digester. The heat was not supplied by steam jackets, as in the Ekman process. The Ritter-Killner method of cooking was brought to America by Governor Russel of Massachusetts and Mr. Charles Riordon of St. Catharines, Ontario, Canada, who built the first sulphite mill in Canada at Merriton, Ontario. The Ritter-Killner process of direct cooking is used almost exclusively in America to-day.

The Development of the Industry

The importance of this industry in Canada is indicated by the tonnage produced. In 1925, two hundred and twenty-seven thousand four hundred and sixty-five tons of bleached sulphite and six hundred and fifteen thousand three hundred and twenty tons of unbleached sulphite were manufactured, making a total production of eight hundred and forty-two thousand seven hundred and eighty-five tons.

The wood consumed to produce this sulphite was approximately one million six hundred and eighty-six thousand cords, representing one billion two hundred million feet board measure, British Columbia log scale. These figures are exclusive of logs used for groundwood in newsprint. Had all these logs been cut in the eastern provinces, it would have denuded a forest over 500 square miles in area, but had it all been cut on the British Columbia coast, one hundred and thirty square miles only would have been stripped. This figure would be a very conservative figure for bush lands on Vancouver island.

In 1924, the United States Department of Agriculture, Bulletin 1241, states:—A recent study of the world's timber supply shows that corniferous species supply nearly one-half of the timber cut in the entire world. They occupy little more than one-third of the world's area of forest lands. Furthermore, the current growth of conifer is less than four-fifths of the cut. The critical timber supply problem of the next half century at least will centre in the corniferous forests.

Sweden is already removing the full annual growth from its forest, while in Norway it is being overcut. The Finnish forests are as a whole being overcut, while many observers foresee the limit of the expansion of the eastern Canadian industry. Apparently the only country in the world outside of the United States which offers opportunity for a long sustained increase in pulpwood supplies commensurate with the increasing world demands is Russia, including Siberia, and a large part of Russia's forests is inaccessible; therefore it behoves all residents of British Columbia to zealously guard their forest property from both fire and from waste in logging operations.

There are no sulphite mills between the provinces of Ontario and British Columbia, but a pulp and paper mill for newsprint is now being constructed in Manitoba that will make its own sulphite. In British Columbia, the Powell River Company makes sulphite for its own consumption in newsprint. Ocean Falls consumes all the sulphite produced there in the company's own paper products. The Howe Sound sulphite mill of the British Columbia Pulp and Paper Company, Limited, make unbleached high grade sulphite. The Port Alice mill of the same company is the only mill west of Ontario making a bleached sulphite pulp.

The amount of capital required to build a bleached sulphite mill, exclusive of hydro-electric plant and timber limits, is between thirty and forty thousand dollars per ton, depending on location. Manufacturing conditions, unless under very exceptional circumstances, make the operation of small independent units unprofitable. By independent units is meant those not operated in conjunction with newsprint or paper mills. A mill is particularly favoured that has a railroad connection and is near the source of timber

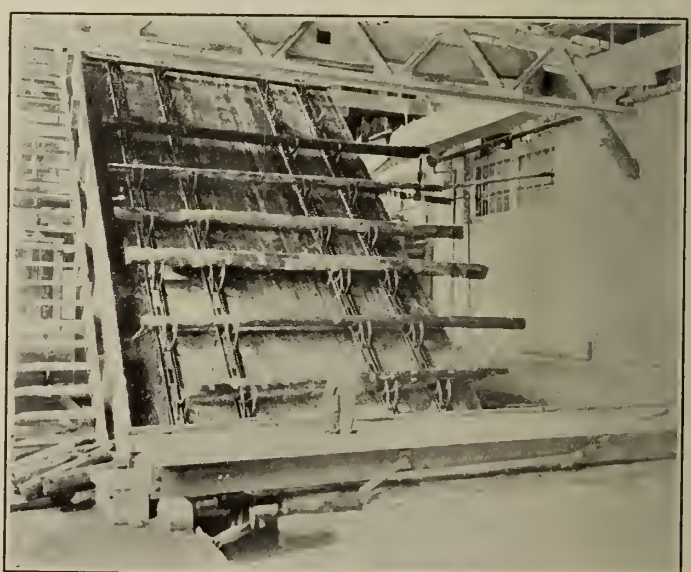

Figure No. 1.—Jack Ladder showing Eastern Pulp Log.

Figure No. 2.—Jenssen Acid Towers.

supply and can accommodate ocean-going vessels at its dock.

The logs most commonly used are white and black spruce, hemlock, balsam and larch, or, to give the latter its correct name, the Amabilis fir. Logging operations are usually conducted by logging superintendents entirely independent of manufacturing operations, but responsible to the same general manager or managing director, as the case may be.

A one hundred-ton mill will give direct employment to about two hundred and fifty men working eight-hour shifts and indirect employment in the bush to as many more.

The raw materials for pulp making are:—wood, sulphur, limestone, fuel, bleaching powder,—either calcium or sodium hypochlorite.

The approximate quantities used per ton of bleached pulp are:—logs, 1,350 f.b.m. or 2 cords,—unbarked; sulphur, 260 to 265 pounds; limestone, 350 to 400 pounds, depending on the grade of rock obtainable; fuel, 1,600 pounds of coal or equivalent oil fuel.

The figure for fuel does not include coal for heating the plant in winter, as the quantity required must necessarily vary according to mill location, especially in Quebec province, where sustained temperatures of 30° below zero are not unusual. Nor does it include fuel used when power is generated by steam units, but is for process steam only for bleached sulphite.

The Manufacturing Process

The manufacturing process can be divided into three groups:—the preparation of the wood; the preparation of the acid and the cooking process; the preparing and bleaching of pulp after cooking.

The preparation of wood comprises the breaking down of logs into chips varying in size from ¾ to ⅞ inch long.

The wood must be first thoroughly barked; that is, the inner skin of the bark must be entirely removed from the outer skin of the wood. Barking can be done mechanically by the rubbing of one log against another in rotating drums or some other type of equipment; by rotating knives and by hand peeling of summer cut wood.

The system of barking used depends partly on size of wood. In the east, where logs are small, barking drums are largely in favour. In British Columbia, the sawmill is the usual method of breaking down large logs and some mills use barking drums for cleaning the slabs from the sawmill, but small round wood, (small relatively as compared with the average run of British Columbia logs), is most suitable for the drums.

In British Columbia, the average size of pulp log varies from 16 to 24 inches. The log is topped at about 10-inch diameter and this top left in the bush as waste. In Quebec, the average size of logs for a year's run measured at a large mill was between 8 and 9 inches, all measurements taken at the top of the log.

Pulpwood logging operators on the coast now leave in the bush about twice as much wood per acre as Quebec grows per acre. The Crown Willamette Company of Portland, Oregon, started salvage relogging operations on their limits two years ago and claim very satisfactory results. Sooner or later, wasteful bush operations must be eliminated if competition is to be met and natural resources conserved. The objection to salvaging tops at present is breakage of the light tops with the heavy type logging equipment used.

The clean wood passes to the chipper, and the chips are delivered to either flat or round screen that separates out the sawdust, large knots and slivers, the chips properly graded being delivered to storage bins above the digesters.

Most sulphite mills use the Jenssen two-tower acid system. It is interesting to note the first concrete acid towers erected in America were built at Hawkesbury, Ontario, and Mr. Mitchell, chief engineer of the Esquimalt drydock, was engineer in charge of the construction. Sulphur, 99 per cent pure, is burnt in rotary burners in the presence of a carefully regulated air supply. The SO_2 gas formed is then either blown or pulled by fans through a lead cooler which reduces the temperature as rapidly as possible from about 900° C to 20° C.

The cooled gas is forced through towers approximately

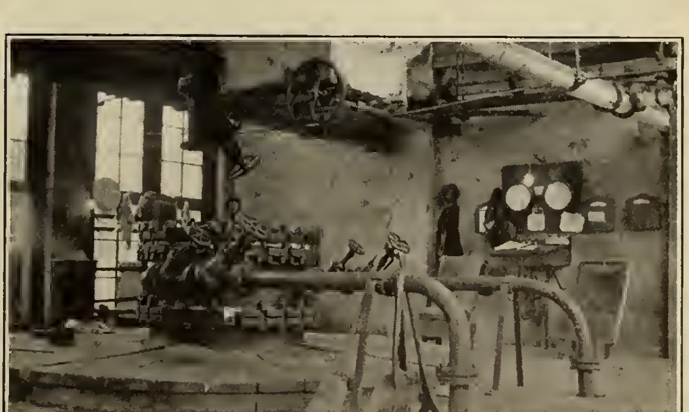

Figure No. 3.—Digester Head showing Connections and Instrument Board, Port Alice, B.C.

Figure No. 4.—Sulphite Drying Machine, Port Alice, B.C.

80 feet high. In the two-tower system, the gas entering the first or strong tower meets the weak acid descending in a shower and trickling over the limestone rock. The gas that is not absorbed in the strong tower passes to the second or weak tower and meets fresh water showering down over the rock. In other words, the surplus gas from the strong tower meets and is absorbed by fresh water and this weak acid meets strong gas in the strong tower. The acid from the strong tower is pumped to the top of a recovery tower filled with material impervious to acid, (usually stoneware rings), flows over the surface of the filling in thin films, thereby offering a maximum of absorption surface to the relief gases that are blown into the recovery tower from the digester during the process of cooking. The finished acid flows by gravity or is pumped into storage tanks ready to be used in the digesters as required. It is advisable to have 18 to 24 hours' storage of acid on hand at all times to ensure proper settling out of sludge, and as a provision in case of stoppages in the acid plant, and also to maintain a uniform acid strength. The amount of acid pumped to a digester in filling is roughly 10,000 litres or 2,500 gallons per ton of pulp. The piping in this department is all hard lead on account of iron piping being attacked by acid.

The Jenssen system permits one tower, (the weak), to be filled with rock while the system is in operation. This saves the cost of a spare tower and cost of rehandling rock. Switching the towers from strong to weak and vice versa is accomplished by an ingenious arrangement of seals and valves, saving a lot of expensive lead piping.

With chips in the storage bin and acid in the tanks, the digesters are ready for charging. In modern practice, chips are filled from the top of the digester and acid enters from the bottom either by an independent acid pipe and inlet in the bottom elbow or through the steam inlet.

A digester is a large steel plate vessel lined with acid proof brick and capable of holding anywhere from 12 to 20 tons of stock. Roughly speaking, one cubic foot of digester space will yield from four to four and one-quarter pounds of bleached pulp.

The digester is brought up slowly to a pressure of about 80 pounds in approximately three hours, and that pressure is then maintained steadily throughout the cook by means of a regulating valve. The pressure is charted on a recording pressure gauge. The temperatures must be carefully controlled at all stages of the cook and are charted on a recording thermometer. The usual cooking time for high grade stock is about twelve hours. The acid in the digester is tested at frequent intervals to gauge how the cook is progressing.

The digester operator is a skilled craftsman, and unless constant care is exercised during the whole cooking time the cook can be very easily spoiled. When the cook is nearly completed the pressure is lowered to 40 pounds, and on completion the blow valve is opened and the contents of the digester is discharged into the blowpit. Skill is required in discharging a digester to have the top cover lifted to prevent a vacuum forming inside the digester, thereby endangering the safety of the digester lining.

Some mills reduce the pressure to zero at the end of the cook and wash the pulp out of the digester with water. The practice does not seem warranted in view of scaling caused by cold water striking the hot bricks of the lining and the undoubted loss of heat from the digester shell that must be replaced during the next cook and the small deep space offered for washing compared to the large and flat surface available in a blowpit. The dimensions of an average digester are 16 to 17 feet in diameter by 40 feet in depth, and a blowpit 56 by 26 feet and 7 to 8 feet in depth.

The pulp being discharged from the digester enters the preparing department, and its cleanliness depends on the efficiency of the screen room. After being washed in the pits until all traces of acid are gone the stock is pumped to rotary knotters whose function is to separate knots and uncooked wood from the fibres. The stock is further cleaned

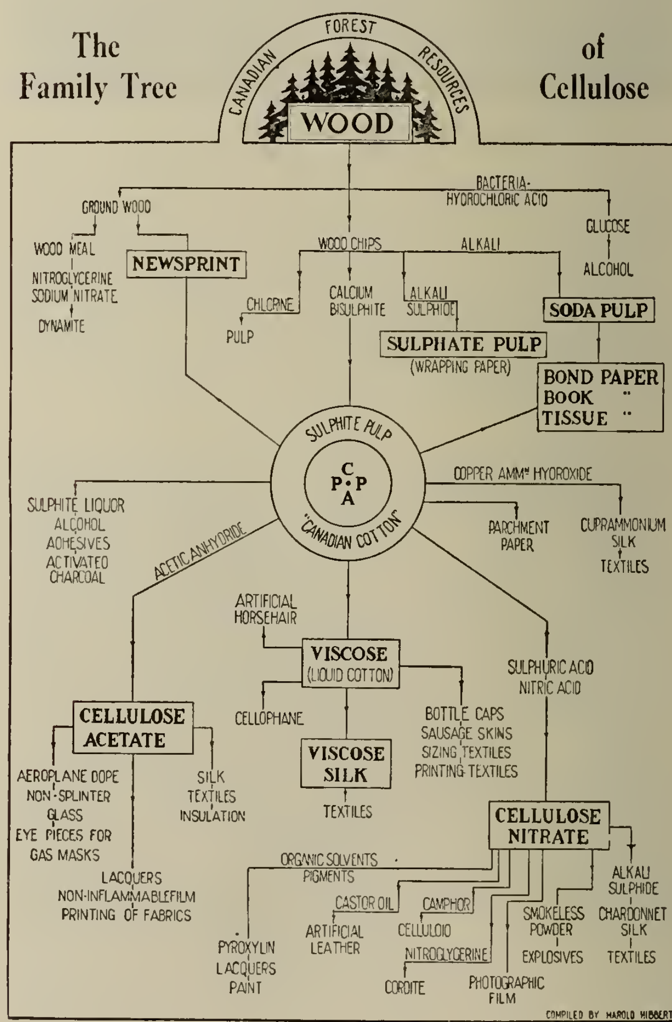

Figure No. 5.—The Family Tree of Cellulose.

on the screens. The flat screen, the rotary screen and the centrifugal screen each have their own particular advocates, but flat screens would seem best adapted for bleached pulp or high grade clean unbleached.

Large amounts of water must be available in the preparing room. The stock flows over the flat screen at a consistency of 1 to 300, that is, one ton of stock is floated over the screen plates by 300 tons of water; thus, a hundred-ton mill would pump over the plates at least 30,000 tons of stock and water per twenty-four hours.

Stock can be run over rifflers either before or after bleaching to remove fine particles of impurities that have passed through the screen plates. The next process is to remove the water that was the vehicle in screening and reduce the stock to a density suitable for bleaching. This density varies from 5 per cent in bellmers to 18 to 20 per cent in a dense bleachery. The advantages of bleaching at as high a density as possible are manifest in the saving of steam and bleach and decreased investment due to the smaller size of equipment required.

A machine will undoubtedly be perfected in the near future that will give a uniform whiteness to the stock equal to that now obtained by the bellmer low density bleachers.

To quote an extract from a paper presented by Dr. Johnson at the cellulose symposium held in Montreal in connection with the Dominion Convention of Chemists:—

"The literature on this subject, (dense bleaching), is still of such a contradictory nature that considerable more research work is needed before we can arrive at definite conclusions as to the comparative merits of the stock concentrations, temperatures and composition in the bleaching solution."

Strong stock requires from 14 to 18 per cent bleach and must never be overheated. The temperatures must be recorded by a recording thermometer. The proper colour being attained, the stock is washed clean of excess bleaching liquor, run over the dry machine, cut into sheets, baled and exported.

The chemist and his assistants play an important part in a sulphite mill. Chemical control supervises all departments, keeping track of white water losses, sewer losses, watching for and correcting any irregularities in acid making and cooking that may occur. Every cook is tested for strength of fibre, freeness and colour. Certain other chemical tests that demand great accuracy are made at regular intervals. The chemist's work is a continuous cycle and embraces certifying that the moisture in the pulp shipped to customer is correctly set forth on the invoice and that the pulp shipped will fill the customer's specifications in every particular.

The engineering problems that are always present in a sulphite mill are largely problems concerning the elimination of waste during all manufacturing operations, efficiency in handling and routing of product at all stages of manufacture, eliminating waste of labour, power, heat and materials.

Heat is an expensive commodity that is extensively used. Between 7 and 8 pounds of steam are required for pound of bleached pulp for process operations, exclusive of any power or plant heating, consequently the steam plant must be up-to-date and efficient.

Heat is now lost in the acid recovery plant and when stock is dumped and washed in the blowpit. Economizers are designed to take care of heat losses from the dry machine. Roughly speaking, the stock enters the dryers at 50 per cent, which means, in round figures, that for every $1\frac{1}{4}$ ton of stock run over the machine about one ton of water must be evaporated and expelled as saturated vapour through the vents.

Stock losses in white water will affect the output unless very closely watched. Wood is the chief raw material in the manufacture of cellulose, and woodroom operations must be closely watched.

Sulphur in the form of SO_2 relief gas can be lost in large quantities by careless cooking.

The engineer who is willing to undergo the drudgery of learning the manufacturing process will find that manufacturing plants afford an excellent field for his efforts, and engineers, either chemical, civil or mechanical, who have executive ability and will give all they have to their employers can rise to responsible and remunerative positions.

The various articles into which sulphite pulp can be manufactured are very numerous and are estimated on the chart prepared by Dr. Hibbart of McGill University.

The chief finished articles are, of course, paper, either bond, book tissue, parchment, greaseproof. The next product, and one still in its infancy, is conversion into rayon. Rayon is a continuous filament and not a spun thread like cotton. It is interesting to note that the province of British Columbia is not lagging behind, and special sulphite is now being regularly manufactured at Port Alice and exported to Japan, where it is converted into rayon. Dr. Hibbart's chart shows two other methods of making artificial silk from sulphite.

Celanese is another product used for aeroplane dope, and the sulphite can be made into a filament similar in appearance to rayon and can be substituted for all purposes for which silk can be used. A celanese plant is now being erected at Drummondville, Que.

It is also interesting to note that pipe is made from sulphite screenings by the Brown Corporation, of Berlin, N.H.

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Annual General Professional Meeting

Montreal, February 14th, 15th, 16th, 1928

Attendance at the Annual Meeting

How often do we hear the questions, in one form or another, "What do I get out of my membership in The Engineering Institute of Canada?" or "What good is it to me?" It is only natural that these questions should be asked occasionally, as there are in The Institute, as well as in every organization of its kind whether technical or purely social, many who believe that they should derive direct and tangible benefits from their membership in societies without the slightest effort on their part in the interest of the organization to which they belong—without, in many cases, exhibiting even sufficient interest to attend its meetings,—and in some instances, although fortunately only a few, without so much as a thought to the matter of its aims, activities.

To these questions, whether they be asked by members of The Institute or by members of some other association, there is only one answer—"You can only benefit from your membership in any society in direct proportion to what you give to it," and this does not in any way refer to the matter of financial support but solely to an active participation in its activities and a conscientious effort to assist in its development and betterment.

The Institute, with its extensive organization; its council of representatives from every section of the Dominion; its numerous committees; its twenty-five active and self-governing branches; and its constant round of activities, offers to its members a host of opportunities to take part in its affairs, so that every member may, if he wishes to do so, assume his responsibilities as a member and personally assist in the work of The Institute. It is in this way and this way only that the full benefits of membership may be realized. The benefits thus accruing are derived from the intimate contact with other members of The Institute; the broadening influence resulting from the constant interchange of professional knowledge, and the opportunity to meet on common ground others engaged in the numerous branches of the profession. What greater return could be wished—for these are admitted requisites of the road to success. It is not possible for every member to hold office or to act on committees, but the same results are obtained, although perhaps not to so great an extent, by attending the meetings and other functions of The Institute.

Throughout the year The Institute, through its branches, holds many meetings. These afford ample opportunity for the members in any particular district to become thoroughly acquainted with one another and to exchange their personal views on professional subjects. However, to obtain the greatest value from membership requires an even broader participation in its affairs, and for this purpose The Institute provides its General Professional Meetings, the most important of which is the Annual General and General Professional Meeting.

The true value of The Institute's Annual Meeting is not solely to be found in the technical sessions, or the visits to engineering works or the social functions, although each of these provides much of interest, but rather in the close association with other members and the resultant bonds of friendship which are established. And it is unquestionably true that there is an atmosphere of real good-fellowship at these meetings, where the doors of friendship stand wide open to all who attend. If further assurance of this fact is needed enquire of those who have attended a recent Annual Meeting of The Institute.

Such a meeting will be held in February of next year in Montreal. An outline of the programme for this meeting appears on another page of this issue. Committees of the Montreal Branch, under whose auspices the meetings are to be held, have been working for several months already on the details of the programme. It is an Institute function and offers to each member of The Institute the greatest opportunity of the year to answer for himself the question "What do I get out of membership in The Institute?"

Proposed Amendments to By-Laws

In accordance with Sections 75 and 76 of the By-laws, the following amendments, proposed by Council and by corporate members, are presented for consideration by corporate members of The Institute and will be discussed at the Annual General Meeting:—

(a) AMENDMENTS PROPOSED BY COUNCIL, ON THE RECOMMENDATION OF THE LEGISLATION AND BY-LAWS COMMITTEE

Section 9. (Age limit for the grade of Junior.)

It is proposed to add to the last sentence of the first paragraph of Section 9 the words "unless in the opinion of Council special circumstances warrant the extension of this age limit."

Section 10. (Age limit for the grade of Student.)

It is proposed to add to the last sentence of the second paragraph of Section 10 the words "unless in the opinion of Council special circumstances warrant the extension of this age limit."

Section 18. (Appointment of Committees.)

It is proposed to delete the words "an Engineering Sections Committee."

Section 24. (Engineering Sections Committee.)

It is proposed to delete this section, and renumber all the succeeding sections.

Section 35. (Schedules of fees.)

It is proposed to increase the annual fees payable by Members, (but not by other grades), by the amount of five dollars, amending

Line 5 to read "Members....$19.00....$18.00"
Line 12 " " "Members.... 16.00.... 15.00"
Line 19 " " "Members.... 14.00.... 13.00"

Section 53. (Sections of Branches.)

In order to provide for the formation of Students' Sections in connection with Branches, it is proposed to add to this Section an additional paragraph, reading as follows:—

"Students' Sections may likewise be established at the request of ten members of a Branch, made in writing to the Secretary of the Branch and approved by the Executive Committee. The rules for such Students' Sections shall be submitted to Council for approval."

Section 68. (Nominating Committees' List.)

Difficulty having arisen from the use of the words "Officers' Ballot" in Sections 68, 69 and 70 to denote not only the list of nominees for office as prepared by the Nominating Committee, but also the actual voting paper sent out to all corporate members for their votes, it is proposed to amend Section 68 as follows:—

Title.— Amend to read "Nominating Committee to prepare list for Officers' Ballot."

Line 1.— Delete the words "an officers' ballot" and replace by the words "a list of nominees for officers."

Line 2.— Delete the words "not less than two" and replace by the words "one or more."

Lines 14, 19, 22.—Delete the words "officers' ballot" and in each case replace by the words "list of nominees for officers."

Line 27.— Delete the word "ballot" and replace by the words "list of nominees for officers."

Section 69. It is proposed to amend this Section as follows:—

Title.— Amend to read "List of nominees for Officers sent to Members."

Lines 2 and 4.— Delete the words "officers' ballot" and in each case replace by the words "list of nominees for officers."

Lines 8 and 10.— In each case insert before the word "ballot" the word "officers."

Section 70. It is proposed to amend this Section as follows:—

Line 1.— Insert after the words "officers' ballot" the words "prepared in accordance with the list and additional nominations, (if any)."

Line 11.— Insert before the word "ballot" the word "officers."

Section 74. In order to authorize the present practice of not requiring subscriptions to the Journal from Honorary Members, Life Members and members who have compounded their fees, it is proposed to amend Section 74 as follows:—

Line 1.— Insert after the word "classes" the words "(except Honorary Members, Life Members and Members who have compounded their fees, who shall receive the Journal gratis)."

Line 2.— Delete the words "(form E in the appendix)."

(b) Amendment Proposed by Corporate Members

Section 29. It is proposed by twenty corporate members of the Moncton Branch to amend this Section as follows:—

"Revise fourth sentence now reading—

"Three or more negative votes shall exclude from election" to read "negative votes must be supported by reasons in writing on the ballot showing wherein candidates' qualifications do not conform to the requirements of the By-laws, and the ballots recording these reasons shall be submitted to the Council, who shall decide upon the validity of the reasons for the negative vote, and if the reasons are approved one or more negative votes shall exclude from election."

Dean Galbraith Memorial

During the Centenary Celebration of the University of Toronto early in October last, a most impressive ceremony took place on the occasion of the unveiling of the memorial bust of the late Dean John Galbraith, founder and for many years directing genius of the Faculty of Applied Science.

The ceremony was witnessed by scores of the former students of the late Dean. High tribute to his achievements were paid by the Hon. and Rev. Canon Cody, chairman of the University's Board of Governors; J. M. R. Fairbairn, M.E.I.C., chief engineer, Canadian Pacific Railway and president of the Engineering Alumni Association, and C. E. MacDonald, chairman of the Memorial Committee and vice-president of the Engineering Alumni Association.

Mr. Fairbairn, after a few introductory remarks, asked Mr. MacDonald to make the presentation to the university on behalf of the association, following which the memorial was accepted by Canon Cody.

The late Dean Galbraith took a great interest in the affairs of The Institute and served on its Council during the years 1894 and 1895, from 1898 to 1901 and again in 1903 and 1906, and was president during the year 1908.

OBITUARIES

James Henry Kennedy, M.E.I.C.

In the death of James Henry Kennedy, M.E.I.C., which occurred at his home in Vancouver, B.C., on October 21st, 1927, there has passed an outstanding figure in the engineering profession; a man whose early work of pioneer of railway construction earned for him a place high up among the engineers of Canada.

A native of Stittsville, Ont., where he was born on March 3rd, 1853, he received his primary education in the schools of that town, later completing his academic training at the School of Practical Science of the University of Toronto, from which he graduated with honours in 1882. Three years later, after a period of practical work, he received the degree of C.E .from the same university. His first engineering work was during the summer of 1882, when he was engaged as rodman and draughtsman on surveys for the Canadian Pacific Railway. In September of the same year he was appointed assistant engineer on the re-measurement of section B of the Canadian Pacific Railway. He continued with the same company, and in April of the following year was assistant engineer on surveys and construction of the lake Superior division. Following this, in 1885, he was associated with Mr. A. D. Baikie, P.L.S., at St. Thomas, Ont., and again entered the services of the Canadian Pacific Railway in May 1887 as assistant engineer of the Detroit extension. Late in that year he was placed in charge of location and construction of the Temiscouata Railway. In May 1889 he entered private practice at Winona, Minn., with Mr. M. S. Parker. His next work was with the Great Northern Railway in Montana, when he was in charge of surveys and construction on the Rocky mountain division of the Pacific extension of that railway. Two years later, in July 1892, he became resident engineer of the Minneapolis, St. Paul and Sault Ste. Marie Railway on the forty miles of extension to Valley City.

During the years 1893 and 1894 he was on the construction of the Soo line, Dakota, as assistant engineer and during this period made an inspection of the bridges on this railroad on the main line between St. Paul and Sault Ste. Marie. In August 1894 he became interested in a machine shop in St. Thomas, Ont., and in addition to his work in this connection he practised as an Ontario Land Surveyor until 1898. On February 8th of that year he went to Vancouver in connection with the surveys in the Yukon for Messrs. McKenzie and Mann under T. H. White, M.E.I.C. On the completion of this work he was appointed chief of surveys in the Okanagan valley from Penticton South. In April of the following year he was sent east of Winnipeg, where he was engaged on work in connection with the Ontario and Rainy River Railway, later part of the Canadian Northern system. For a short period he was with the British American Coal Company on topography and prospecting work. In November of 1900 he had charge of surveys for the Algoma Central Railway until he resigned to accept the position of chief engineer of the Vancouver, Victoria and Eastern Railway and Navigating Company, where he remained until August 15, 1915. Since that date he continued to act in various capacities for this company and at the same time practised as a consulting engineer. Among his later works was the inspection of the Great Eastern Railway for the British Columbia government during 1916; consulting engineer for the Brooks Scanlon O'Brien Logging Company, for which organization he located and constructed some twenty miles of railway system.

The late Mr. Kennedy was among the first members on the roll of The Institute at the time of its formation as the Canadian Society of Civil Engineers, having joined that society as an Associate Member on January 20th, 1887, his election as Member taking place later, on May 18th, 1893. He was a member of the American Society of Civil Engineers and was commissioned an Ontario Land Surveyor in 1887. He had many and varied interests, and was vice-president of the Pacific Investment Corporation of Vancouver and a member executive of the Convocation of the University of British Columbia.

About four years ago, Mr. Kennedy retired from active practice. An interesting reference to Mr. Kennedy's work was published in the February 1924 issue of the Journal, accompanied by a photograph including in addition to Mr. Kennedy, H. J. Cambie, M.E.I.C., and T. H. White, M.E.I.C., which photograph was taken by the Vancouver Branch of The Institute in Vancouver on October 6th, 1923.

William Lemuel Scott, M.E.I.C.

It is with regret that we record the death of William Lemuel Scott, M.E.I.C., which occurred at his residence in Outremont, Que., on November 2nd, 1927. Three months prior to his death, Mr. Scott underwent a major operation from which he never recovered his health and strength.

He was born at Somerville, Mass., in 1852, and commenced his engineering work in 1870 as rodman and chainman on railway work, later becoming division engineer on the same work. In 1872 he was engaged with the late Thos. C. Keefer as assistant engineer on the Ottawa water works. He moved to Montreal in 1875 and occupied a similar position with the Harbour Commission of Montreal under the late Sir John Kennedy. He was engaged on this work until 1879, when for three years he discontinued the practice of engineering. He returned to the profession in 1882 and he was again engaged on the work of the Montreal harbour, his work at first being principally in connection with surveying and preliminary details. The following year he was appointed assistant engineer on the ship channel works for the Harbour Commission. Later, when the construction of the Quebec bridge was commenced, he was assistant engineer in charge of bridge foundations for Mr. M. P. Davis. Following this work, he became consulting engineer to Mussens, Limited, Montreal, and later was associated with Watson Jack and Company, Limited. About five years ago he met with a serious accident, from which he never really regained his normal health, so that he was forced to retire from active work.

The late Mr. Scott joined The Institute in its early days as the Canadian Society of Civil Engineers, when he was elected a Member on January 20th, 1887.

THE ANNUAL MEETING

THE ANNUAL GENERAL AND GENERAL PROFESSIONAL MEETING

of THE INSTITUTE *will be held*
in MONTREAL *on*

TUESDAY, WEDNESDAY AND THURSDAY
FEBRUARY 14th, 15th AND 16th, 1928

With headquarters at THE WINDSOR HOTEL

A programme of papers of outstanding merit, and of interest to all branches of engineering, is being arranged for this meeting.

His Excellency The Governor-General has graciously consented to attend the Annual Dinner and to address the members on that occasion.

Provision is being made for visits to various engineering and industrial works of interest. A number of these have recently been completed, while others are in course of construction.

Special arrangements will be made for the entertainment of visiting ladies.

Some of the Papers to be Presented and Discussed and Works of Interest to be Visited

PAPERS

Chippawa Creek Syphon Culvert of the Welland Canal. Lock Gates of the Welland Canal. Movable Bridges of the Welland Canal. Foundations of the Royal Bank Building, Montreal. Structural Steel Work of the Royal Bank Building. Removal of Carbon-Sulphur Compounds from Gas. Flow of Gases in a Reverberatory Furnace. Tests and Performance of a Uniflow Steam Engine. Durability of Concrete Structures.

WORKS OF INTEREST

Montreal-South Shore Bridge.

New Cold Storage Warehouse.

Coking Plant of the Montreal Light, Heat and Power Consolidated.

City Interceptor Sewers.

Plant of the Associated Screen News.

New Royal Bank Building.

Outline of Programme

(TENTATIVE)

TUESDAY, FEBRUARY 14TH

Morning—
Registration—Annual General Meeting of The Institute, including presentation of reports of Council, Committees, and the Branches; Scrutineers' report of the election of officers — Retiring President's address—Induction of newly-elected President.

Noon—
Reception and Luncheon.

Afternoon—
Annual General Meeting continued.

Evening—
Smoker.
Entertainment for Ladies.

WEDNESDAY, FEBRUARY 15TH

Morning—
Technical Sessions.

Noon—Luncheon.

Afternoon—
Visits to points of interest.

Evening—
Annual Dinner of The Institute.

THURSDAY, FEBRUARY 16TH

Morning and Afternoon—
Technical Sessions.

Evening—
Supper Dance and Bridge.

ILLUSTRATIONS

Left: Main Channel Piers and End of South Shore Steel. — October 22nd, 1927.

Below: Perspective Sketch of Main Channel Crossing.

PERSONALS

R. A. H. Hayes, S.E.I.C., is with H. G. Acres and Company, Limited, at Niagara Falls, Ont.

J. C. Nutter, Jr.E.I.C., has resigned his position of electrical engineer, Groveton Paper Company, Inc., Groveton, N.H., and has joined the staff of the Nashwaak Pulp and Paper Company, St. John, N.B. Mr. Nutter graduated from McGill University in 1921.

G. W. Lusby, S.E.I.C., has accepted a position in the engineering office of the Ford Motor Company of Canada at Ford, Ont. Mr. Lusby is a graduate of Acadia University of the year 1923 and of the Nova Scotia Technical College of the year 1925, having received the degree of B.Sc. in mechanical engineering from the latter.

D. L. Carr, A.M.E.I.C., is located in Maliano, Santander, Spâin, with the Standard Electrica S.A. Mr. Carr has been for the past year in London, England, prior to which he was located in Montreal as cable sales specialist with the Northern Electric Company, Limited. During the war he served in the Royal Artillery from early in 1915 until demobilization in May 1919.

W. O. Stevens, S.E.I.C., has been transferred from the staff of the John S. Metcalf Company, Limited, head office in Montreal, to the office in Vancouver, B.C. Mr. Stevens is a graduate of McGill University of the year 1925, and prior to attending McGill he was for one year at the University of Manitoba. He was also for a time at Arvida, Que., with the Aluminum Company of Canada.

E. K. Macnutt, S.E.I.C., has joined the staff of the William Hamilton, Limited, at Peterborough, Ont. Mr. Macnutt has recently been with the Port Alfred Pulp and Paper Corporation, Port Alfred, Que. He is a graduate of McGill University of the year 1924, and subsequently was with the E. B. Eddy Company at Hull, Que., until receiving his appointment with the Port Alfred Pulp and Paper Corporation.

G. V. Helwig, S.E.I.C., T. R. Durley, S.E.I.C., and P. E. Dalton, S.E.I.C., who are students at McGill University, have been awarded tutorial bursaries to upper classmen in the Faculty of Applied Science, according to a recent announcement made by the Dean of the faculty. These bursaries were founded by Dr. James Douglas and are given annually to upper classmen in the Faculty of Applied Science who have distinguished themselves in certain subjects.

J. A. MacGillivray, A.M.E.I.C., is resident engineer with the Manitoba Power Company at Grand Falls, Man. Mr. MacGillivray has until recently been located at New Glasgow, N.S. He was for a number of years located in Manitoba on various engineering works, including sewer construction, bridge work in connection with the highways system of the province and power house construction for the city of Winnipeg. He was later on the staff of the Manitoba Public Utilities Valuation Board engaged on work in connection with the Winnipeg Electric Railway.

F. M. Barnes, A.M.E.I.C., has been appointed to the staff of the Saint John Harbour Commission at Saint John, N.B. Mr. Barnes has been located in Saint John since 1914 in the position of assistant engineer with the Department of Public Works of Canada. He is a native of England, and his first work on coming to Canada was with the water works and sewerage department of the city of Saint John from 1907-10. His principal work since that date, until joining the Department of Public Works, was in connection with the Canadian Pacific and Canadian Government Railways.

A. G. Tapley, A.M.E.I.C., assistant engineer with the Department of Public Works of Canada, who has been located in Saint John, N.B., since 1909, has been transferred by the department to Halifax, N.S., following the placing of the Saint John harbour under the jurisdiction of the Saint John Harbour Commission. It will be recalled that Mr. Tapley was awarded the Gzowski Medal for his paper entitled "Concrete in Sea Water," which was published in the November 1924 issue of the Journal. Mr. Tapley has been most active in the affairs of The Institute, having served on the executive of the Saint John Branch in 1921 and as chairman of the branch in 1922.

E. A. Thomas, A.M.E.I.C., assistant engineer with the Department of Public Works of Canada at Saint John, N.B., has been appointed to the staff of the Saint John Harbour Commission. With the exception of a period of his service overseas from early in 1915 to his demobilization at the end of the war, Mr. Thomas has been located at Saint John. His first work on coming to Canada from England was with the city water works department. In 1908 he was appointed assistant engineer of the Department of Public Works at the office of the resident engineer at Saint John. His work since that date has been principally in connection with the harbour and river.

J. A. Loy, A.M.E.I.C., has been transferred by the Bell Telephone Company of Canada from Ottawa to Montreal, where he will undertake the duties of special studies engineer. Mr. Loy graduated from McGill University in 1921 and following graduation was engaged for two years on survey work in connection with the James bay extension of the Temiskaming and Northern Ontario Railway, during which time he was chief of party. In May 1923 he joined the staff of the Bell Telephone Company as plant engineer and in July 1925 he was appointed district plant engineer at Ottawa, in which position he remained until his present promotion.

H. A. Oaks, Jr.E.I.C., is located at Winnipeg, Man., with the Western Canada Airways. Mr. Oaks is a graduate of the University of Toronto of the year 1922. Following graduation he was with the Hollinger mine in the position of surveyor's assistant. During 1923 he was engaged on prospecting work in Ontario and Quebec and in the following year was on instrument work and inspector on the Hollinger power line construction. In July 1924 he joined the staff of the Ontario Forestry Branch Air Service as pilot. During the Great War he was with the Canadian Engineers, the Signal Corps, until 1917, when he became pilot and flight lieutenant with the Royal Flying Corps.

J. G. Culshaw, A.M.E.I.C., has resigned from the staff of the Dominion Water Power and Reclamation Service of the Department of the Interior, Calgary, Alta., and is now resident engineer with the Canadian National Railways, western region. Mr. Culshaw is a native of Lancashire, England, and received his education in the Old Country. He came to Canada in 1907, when he was engaged on construction with the Grand Trunk Railway. Up to the time of the Great War he was engaged principally on railway work in western Canada. Following his service overseas, which was throughout the entire period of the war, he returned to Canada and was attached to the staff of the Commissioner of Irrigation as field draughtsman on reclamation work.

F. B. Kilbourn, M.E.I.C., who has been general superintendent of the Canada Cement Company, Limited, since 1919, has been reappointed to the same position by the new management. Mr. Kilbourn was born at Owen Sound, Ont., and after completing his public and high school education he undertook some studies at McGill University during the years 1905 and 1906. Prior to this, in 1901, he was for three years with the Montreal Light, Heat and Power Corporation on hydraulic construction work and operation of generating stations. In 1906 he was in charge of the construction and operation of the Canada Cement Company's Number 1 plant, on which work he was engaged until 1919, when he was appointed general superintendent of the company's plants.

A. M. Mackenzie, A.M.E.I.C., has been transferred by the Bell Telephone Company of Canada from Montreal to Toronto, where he will be division plant engineer of the central division. Mr. Mackenzie graduated from the University of Toronto in 1914 with the degree of B.A.Sc. and in 1920 received the degree of E.E. from the same university. He joined the staff of the Bell Telephone Company in 1908, and was first engaged on line construction and repair work; this work was carried on during his summer vacations while at the university. In 1914 he was appointed to the position of wire chief at Guelph, Ont., and has been with the company since that date, occupying various positions, except during his service overseas, when he was lieutenant with the Canadian Engineers.

Col. J. Sutherland Brown, C.M.G., D.S.O., AFFILIATE E.I.C., has been chosen to attend the Imperial Defence College for the course of 1928. This college was established in 1926 by the British Government for the study of higher imperial strategy and imperial organization for war. The first course took place during the present year, to which Canada sent Brig.-Gen. A. G. L. McNaughton, D.S.O., M.E.I.C., and it is to the second course that Col. Brown is being sent. Col. Brown entered the Canadian militia thirty-three years ago and has been on the Canadian Permanent Force for nearly twenty-seven years. He obtained a p.s.c. at the Staff College, Camberley, in 1914. He has been interested and associated with engineers and engineering for a number of years, particularly in connection with surveying and the production of maps for the Militia Department.

Roy A. Crysler, A.M.E.I.C., has been appointed to the staff of Messrs. Chapman and Oxley, architects, of Toronto. Mr. Crysler graduated from the University of Toronto in 1920, his course having been interrupted by his service overseas with the Canadian Engineers and Royal Air Force for a period of from 1916 until 1919. During the summer, prior to his graduation, he was resident engineer for Messrs. James, Loudon and Hertzberg on roads and sewer construction. After graduation, he was appointed assistant engineer with the Provincial Board of Health of Ontario and later, for a short period, he was engineer and surveyor for the Town Planning Commission of Niagara Falls. Subsequently, he was appointed to the staff of the Hydro-Electric Power Commission of Ontario at Niagara Falls, where he remained until April 1922, when he became engineer with the city architect's department at Toronto, later being appointed structural and reinforced concrete engineer with the same department. In September 1926, Mr. Crysler went to the United States with the H. K. Ferguson Company and was engaged on construction work until his recent appointment in Toronto.

J. L. BUSFIELD, M.E.I.C.

C. K. McLEOD, A.M.E.I.C.

Institute Councillor and Secretary of Montreal Branch Form Partnership

J. L. Busfield, M.E.I.C., and C. K. McLeod, A.M.E.I.C., have entered into partnership under the firm name of Busfield, McLeod, Limited, successors to Chemical Engineering Equipment Company, Limited. Both Mr. Busfield and Mr. McLeod have been prominent in the affairs of The Institute for years; the former at present being councillor representing the Montreal Branch and the latter secretary-treasurer of the Montreal Branch. The headquarters of the new company is in Montreal, with offices in the Keefer building.

Mr. Busfield is a native of London, England, where he was born in 1888. He was educated at the City of London School and Dulwich College, and in 1907 graduated from the Central Technical College, (City and Guilds Institute), and London University, receiving from the latter the degree of B.Sc. with honours in engineering. Following graduation, he came to Canada and for five years, 1907-12, he was with the eastern division of the Grand Trunk Railway, first on the resident engineer's staff and later as principal assistant to the resident engineer. During this period he was engaged in both office and field work, the latter including maintenance and construction. In 1912 he was appointed chief of party in charge of surveys with the Mount Royal Tunnel and Terminal Company in connection with the construction of the 3½-mile double-track tunnel through Mount Royal at Montreal. Subsequently, he became assistant engineer in charge of surveys and alignment on the eastern division of the work, and later office engineer in charge of the preparation of the terminal designs. In 1915 he became engineer with the chairman of the Georgian Bay Canal Commission and was engaged in investigating the economic feasibility of this project. In 1916 he joined the staff of the Walter J. Francis and Company as principal assistant, and during the following six years he was engaged principally on hydro-electric work. From 1922 until quite recently he was partner with de Gaspe Beaubien, M.E.I.C., under the firm of Beaubien, Busfield and Company, Montreal, and in this capacity was in charge of the construction of hydro-electric plants, reporting on numerous similar projects and other related work. Mr. Busfield is the author of a number of papers which have been presented at meetings of The Institute, including the following:—Design of Passenger Terminals, The Mount Royal Tunnel, The Manitoba Power Situation, The Hudson Bay Railway and The Chicago Drainage Canal. He has taken a very active part in the affairs of The Institute and has given a great deal of his time to its work. From 1919-22 he was secretary-treasurer of the Montreal Branch; in 1924 he was elected vice-chairman of the branch and in 1925 chairman; in 1926 he was elected member of Council, representing the Montreal Branch for a period of three years. He has been chairman of the Papers Committee and Finance Committee of The Institute during the past two years and was chairman of the Publication Committee during 1926. He is a charter member of the Corporation of Professional Engineers of Quebec and the Association of Consulting Engineers and an Associate Member of the Institution of Civil Engineers and a Member of the American Society of Civil Engineers.

Mr. McLeod was born in Montreal in 1889, and, after attending the public and high schools in Montreal, he entered McGill University and graduated with the degree of B.Sc. in chemical engineering in 1913. Immediately after graduation he became plant chemist with the Canada Cement Company, Limited, remaining with this company for the next three years. In 1916 he was engaged on the inspection of explosives with the Imperial Ministry of Munitions and remained on this work until the end of 1918, during the last eighteen months of which time he was district inspector. In May 1919 he was appointed chief chemist for the Dominion Glass Company and one year later became superintendent with the Consumers Glass Company. In May 1921 he was with the Phoenix Bridge and Iron Works on design and sales of structural steel work. When this firm was taken over in October 1923 by Canadian Vickers, Limited, he occupied a similar position with the new organization. In 1925 he became manager of the Chemical Engineering Equipment Company, which company acted as sales agents for various engineering specialties, and it is this organization which has been succeeded by the new firm.

The new company will engage in sales engineering representing a number of well-known manufacturers, including:—Walter Kidde Company, Limited, CO_2 fire extinguishing systems; Permutit Company of Canada, Limited, water softeners; American Hard Rubber Company; Priestman Brothers, excavating and dredging machinery; Morris Henty and Gardners, oil and semi-Diesel engines; and other firms producing marine engines, chemicals and coal measuring apparatus.

ELECTIONS AND TRANSFERS

At the meeting of Council held on November 25th, 1927, the following elections and transfers were effected:—

Associate Members

GORMAN, John J., B.Sc., (Univ. of N.B.), field engr. i/c constrn. of main dam and tunnel intake for St. John River Power Co., Grand Falls, N.B.

Transferred from the class of Junior to that of Associate Member

BENNETT, Charles Samuel, B.Sc., (Univ. of N.B.), with Fraser Brace Engrg. Co. on Chelsea, Farmers Rapids and Paugan Falls developments, Paugan Falls, Que.

MACDONALD, James William, chief engr. with Int. Petroleum Co., Talara, Peru.

ROBERTSON, Robert McFadzean, B.Sc., (McGill Univ.), structural designer with Dom. Bridge Co., Lachine, Que.

ROCHESTER, Gordon H., B.Sc., (McGill Univ.), ch. of timber tests, Forest Products Lab., Ottawa, Ont.

Transferred from the class of Student to that of Associate Member

MacQUARRIE, Edison Malcolm, B.A.Sc., (Univ. of Toronto), private practice, Sault Ste. Marie, Ont.

SCHAEFER, Joseph Godfrey, B.Sc., (Queen's Univ.), sewage engr. and supt. of sewage disposal works, Regina, Sask.

Transferred from the class of Student to that of Junior

BRADFIELD, John Ross, B.Sc., (McGill Univ.), asst. to ch. engr. Horne Copper Corp., Noranda, Que.

BUTTERWORTH, John Victor, B.Sc., (N. S. Tech. Coll.), topographical engr., i/c party, Geological Survey of Canada, Ottawa, Ont.

CLUFF, Harold David, B.Sc., (Univ. of Man.), officer i/c radio stations operated by Dept. of Nat. Defence in Western Can., Arctic, Aklavik, N.W.T.

COCKBURN, John Macmillan, B.Sc., (Queen's Univ.), commercial engineering, head office, Can. Gen. Electric Co., Toronto, Ont.

DAVISON, John Laurence, B.Sc., (N. S. Tech. Coll.), i/c electrical work for Can. Comstock on Can. Celanese Co., Drummondville, Que.

LEITCH, Hugh James, B.Sc., (McGill Univ.), res. engr. on erection of steel lock gates, Welland Ship Canal, with Steel Gates Co., Ltd., St. Catharines, Ont.

MacNUTT, Erskine K., B.Sc., (McGill Univ.), asst. to res. engr., Port Alfred Pulp & Paper Co., Port Alfred, Que.

REEKIE, William George, B.Sc., (Univ. of Man.), asst. res. engr., Fort William Paper Co., Fort William, Ont.

An Announcement

REGARDING THE

ANNUAL MEETING

APPEARS ON PAGE 535
OF THIS ISSUE

Read it—and plan to attend

ABSTRACTS OF PAPERS

Gatineau Valley Developments

Walter Blue, A.M.E.I.C.,
Manager of Development, Gatineau Power Company.
Ottawa Branch, October 27th, 1927

Previous to the International Paper Company, of which the Gatineau Power Company is a subsidiary, appearing on the scene, the principal industry of the Gatineau valley was lumbering, chiefly of pine, Mr. Blue told the audience. Development of the Gatineau power would not have been possible had not a market been in sight for the output, and this was furnished primarily by the great pulp and paper project built at the mouth of the Gatineau and extended by the contract for 260,000 horse power to be taken by the Hydro-Electric Power Commission of Ontario. In addition, power is being taken by the Canada Cement Company and the new fibre-board plant being erected at Gatineau will be another large consumer. Surveys have also been made for a 110,000-volt line to Hawkesbury to supply the International Paper Company's mill there.

The Gatineau river, said Mr. Blue, drains an area of 9,600 square miles, an area in which the Canadian International Paper Company owns large limits of pine and pulpwood. The river serves for the transportation of logs as well as the development of power, and in describing the lay-outs of the power plants he touched on the log chutes provided for passing logs. The log chute past the Chelsea and Farmers rapids developments was being used to pass as many as 120,000 pieces of timber in twelve hours.

Mr. Blue stressed the part which regulation has had to do with the development of power on the Gatineau. Through the building of the Mercier dam, under the supervision of the Quebec Streams Commission, lake Baskatong has been increased in area from 19 to 115 square miles, providing 100,000,000,000 cubic feet of storage, the third largest artificially created reservoir on the continent, and the minimum regulated flow has been increased to 9,000 cubic feet per second, as compared with the previous minimum of 2,100 cubic feet. The Gatineau river falls altogether 1,200 feet from its headwaters. In the developments being carried out or contemplated below the Mercier dam, 375 feet out of a total head of 383 feet is to be utilized, a loss of only 8 feet in 75 miles. The plants are arranged so that the headwater of one development is the tailwater of the one above.

At the present stage of development, Mr. Blue stated that three out of five units of 24,000 horse power are in operation at Farmers rapids. At Chelsea, only 7,000 feet upstream, three out of the five 34,000 horse power units to be installed are in operation. At Paugan falls, 26 miles higher up, construction is far advanced and a total installation of eight units of 34,000 horse power is provided for, with the first installation to be six units. Some 45 miles above the Paugan development it is proposed to locate the Maniwaki power house. Mr. Blue did not touch on prospective developments above the Mercier dam, other than to state that the company is investigating other storage sites in the Gatineau watershed.

The transformation which has taken place in the Gatineau valley was perhaps best emphasized by Mr. Blue when, in his preliminary remarks, he stated that the only power development on the river, prior to the International Paper Company coming in, was an installation for sawmill purposes of 16 horse power at Chelsea. In taking over the Riordon interests in the valley, the development of the natural resources of the Gatineau is being carried out on a huge scale and the newsprint industry has already four machines in operation turning out paper over 21 feet in width at a rate of 1,200 feet a minute. Gatineau power is spreading over a wide territory on transmission lines of 110,000 and 220,000 volts, the latter being the voltage of the line which the company will construct from Paugan falls to the Ottawa river near Quyon, where the power will be delivered to the Hydro-Electric Power Commission of Ontario. The proposed extension of the line from the Gatineau mill to Hawkesbury will carry 110,000 volts.

Mr. Blue paid tribute to the efficiency of the Fraser-Brace Company, which built the paper mill, the Farmers rapids and Chelsea power plants and is constructing the Paugan falls plant, and to the two hundred engineers, practically all Canadians, who had helped to make these developments possible. More than 90 per cent of all construction material and installed machinery was of Canadian manufacture, he said.

Mr. Blue's address was interspersed with many details of construction which were of great interest in indicating the magnitude of the work. One of the big jobs was the excavation of 190,000 cubic yards of rock at Chelsea. In addition to actual construction on the power projects, five miles of the Canadian Pacific Railway were relocated as well as five miles of the provincial highway. In closing, he extended thanks to various government departments which had rendered valuable assistance in providing surveys and information which assisted in planning the developments. These included the Geodetic Survey, Geological Survey, Dominion Water Power and Reclamation Service, Public Works Department and the Topographical Survey.

The Differential Vacuum System of Steam Heating

M. W. Shears, Heating Engineer,
C. A. Dunham Company, Limited, Toronto, Ont.
Kingston Branch, October 18th, 1927

The science of heating has progressed very rapidly during the past decade or two. It is a long cry from the old one-pipe gravity system and the later developed two-pipe gravity system to the present day atmospheric and vacuum systems of steam heating.

Manufacturers of heating apparatus, universities and engineering associations have in recent years done considerable research work towards making improvements and effecting economies in the heating of buildings. This investigation has mainly had to do with the determination of the rate at which heat is transmitted through buildings of various construction; with improvements in the means of distributing heat to the rooms to be heated, that is, radiator and boiler designs; and with the design of piping systems to ensure noiseless circulation. Many types of special fittings have been placed on the market, some to fall into the discard, others to remain and prove their efficiency through long years of service. However, until recently the improvements made have not been of such a nature that their application produced a system of heating that controlled the supply of heat to a building at the rate at which heat was lost during the varying weather conditions experienced. This desirable condition is now made possible by the development of differential vacuum system of steam heating.

No matter what type of heating system is selected, it must have sufficient capacity to furnish heat during the most severe weather conditions; that is, boilers should be large enough to supply at such times sufficient heat units to the medium of distribution. The piping should be of such size to permit the flow of the proper amount of the heat medium to radiators at such size that these can emit sufficient heat to the building; and all, of course, should be in their proper relation. To design and install a system to meet these requirements does not present a very difficult problem to-day.

Those engaged in the study of heating problems, however, realized that a system designed to meet the most severe conditions considerably overheats a building during the milder weather, which constitutes about 90 per cent of our heating season, and that during this period considerable wastage of heat often takes place and adds to the tendency of occupants to open windows to create a cooler and more comfortable atmosphere.

It seems impracticable to expect that heat will be efficiently regulated by the layman by the use of the valve on a radiator, and as a result various types of temperature control have been developed which do function satisfactorily. There still is, however, window opening, which no temperature control seems to prevent. An open window renders a system of temperature regulation useless so far as the room in which the window is located is concerned, and naturally results in heat waste. Temperature regulation is somewhat costly to install, and this affects, of course, its use in many types of building.

It has been mentioned that a system can be designed to meet the most severe weather conditions. If that same system can be made to meet the ever-changing weather conditions and supply heat sufficient to balance the heat loss from the building at all times, we would say that we had the most economical heating system possible.

A study of the graph of temperatures for Toronto during the winter of 1926-27 shows an average temperature for the season of 36.3°. On only two days did the average temperature fall below zero. Heating systems in Toronto are usually designed to give 70° inside when outside temperature is 10° below zero. Once every few years Toronto has a few days where the thermometer falls to about 30° below zero. This period, however, is short, and usually the heating system can be boosted to meet the extra demand on it. For a large portion of the season the temperature is above the average of 36.3°. It is during this time that most heat is wasted, due to over-heating and window opening. This means a direct loss of fuel.

Experience shows that windows are opened when 80° is reached, otherwise room temperature would continue to rise.

The most practical method of eliminating waste of fuel would be to furnish steam to the radiator at such a temperature as would cause the radiator to emit a sufficient amount of heat to correspond with the heat lost from the building for any weather condition and to maintain a given room temperature. A system of this kind would have to work at sub-atmospheric pressures. The heat waste mentioned can be accounted for by the limited range of present types of heating systems, giving differences between the radiator and room temperatures from 125° to 150° for vacuum return line systems. Gravity systems would have a lesser range, since circulation would not be positive below atmospheric pressure. The differential vacuum system has a much wider range, which makes possible the economies experienced by its use.

The comparative heat emission by radiation of present heating systems with that of the differential vacuum system, based on a design pressure of 2 lbs. gauge, shows that, at a difference of 70° between inside and outside temperature, the radiators on both systems emit an equal number of B.t.u.'s. On present types of systems the minimum B.t.u.'s emitted are 180, while the differential vacuum system drops to around 63 B.t.u.'s, and it is this wider range which produces the economies of this new system.

To obtain the wide range of heat emission, it is essential that steam be circulated through the radiation under varying pressures and corresponding temperatures that will make possible this varying heat emission. Referring to the steam table, it is seen that for the usual design conditions of 2 lbs. steam pressure for low-pressure heating systems the design steam temperature is around 219°. The present range of operation to ensure circulation on present heating systems is from about 3 inches of vacuum to 2 lbs. gauge with a temperature range of about 14°. If a method can be developed whereby steam can be circulated under a fixed differential at pressures varying down to, say, 25 inches of vacuum, the range of steam temperatures would be increased about six times, giving a range of 87° to meet the varying heat loss due to changes in weather temperatures. It is possible under the condition of a declining fire to produce a vacuum in a tight steam heating system of around 10 to 15 inches, but the pressure between the radiators and the return piping very quickly equalizes, circulation ceases and the radiators quickly cool. Steam under the condition just described will not keep the remote parts of the radiator hot, neither will steam flow into a cold radiator after the valve has been opened.

Consider the relation of heat loss and heat emission to temperature difference. For a given room with outside temperature of zero and room temperature of 70°, a heat loss is calculated equal to 10,449 B.t.u. It is possible to determine the size of radiators that, when supplied with steam at 2 lbs. gauge pressure, will give off the required number of B.t.u.'s for this condition as well as when the outside temperature rises to plus 20°, the heat loss being then only 7,461 B.t.u. This heat loss can be balanced by reducing the pressure of the steam in the radiator correspondingly, which prevents over-heating, and economy of operation results with more healthful conditions. The volume of steam of the required weight at various pressures is relative. The steam has twice the volume for the 21.1 inches of vacuum condition that it has for the design condition of 2 lbs. Therefore there is no hesitation in saying that the radiators will be filled with steam under the varying sub-atmospheric pressures likely to be carried to meet the varying weather conditions. The approximate steam pressures on which the system should operate to meet the varying demand can be determined. It is readily found that when outside temperature is plus 20° the steam pressure should be around 15 inches of vacuum if the base temperature of design was zero.

To obtain the conditions required by the differential vacuum heating system, it is necessary first that a thermostatic trap be installed on each radiator, and that this trap be of such design that it will function to close off against steam and open to release air and water from the radiator under varying pressures ranging from 25 inches of vacuum to 25 pounds pressure. If the trap is efficient, the inlet and outlet temperature curves are parallel throughout the range of pressures. The radiator efficiency runs almost 100 per cent consistently. The condensation drops off considerably as pressures are reduced, and it is this fact that produces the economies.

The design of the steam piping system must, of course, be proportioned to the heat demand of each radiator. Careful designing and good installation with proper pipe sizes will do much to give the desired distribution. A regulating plate of proper size inserted in the packless valve on each radiator will assure that each radiator receives its proportionate amount of steam during the heating up period when the radiation is not filled with steam. When radiators are filled with steam, the thermostatic traps adjust themselves to the flow of condensation from the radiator, the regulating plate having served its function. The radiator inlet valve must be packless, since the entire system will, for the major portion of the heating season, be operating under a high degree of vacuum which would be destroyed by using packed valves, which would invariably leak about the stems. It is essential to the satisfactory operation of the system that packless valves and thermostatic radiator traps be used.

A vacuum producer capable of developing a very high degree of vacuum must be used. This must be accomplished in a manner that will definitely maintain a fixed small pressure differential between the steam in the radiator and the returns. This differential will furnish a head sufficient to cause a flow always toward the return, even when the radiation is functioning at low sub-atmospheric pressures. The air and condensation from the radiators will then be released as quicky as it is formed, causing them to fill completely with steam at the right temperature for quickly meeting variations in weather and to balance the heat loss of the building with room temperature remaining reasonably even.

The vacuum producer is designed with only one moving part, the centrifugal pump. The vacuum is produced on the ejector principle, with the design of the nozzles and delivery tubes commensurate with the work to be done. The vacuum is not produced in the receiver from which the centrifugal draws the condensate. Its design makes it possible to pull a vacuum as high as 27 inches at the pump and maintain a vacuum as high as 25 inches on the heating system. Water is drawn from the receiving tank by the centrifugal and discharged at constant pressure of 20 pounds through the exhauster nozzles creating a high vacuum in the exhauster body, causing air and water to flow into it from the return main and be carried through the delivery tube into the receiver. As the water accumulates, the float in the receiver rises, opening the discharge valve, and the surplus water returns to the boiler at the rate that condensation flows from the return into the receiver.

In the typical arrangement of the differential vacuum system, when operating under manual control, the steam is generated in the boiler and furnished to the piping system through sub-atmospheric pressure reducing valves. The larger reducing valve is for use during the severe weather conditions, and the small reducing valve is to be used for mild weather conditions encountered in spring and fall. The levers may be weighted at either end to control steam pressures above or below atmospheric. The system of return piping is connected by an equalizer connection to the differential controller mounted on the differential pump. Each radiator is equipped with a thermostatic radiator trap and a packless inlet valve with regulating plate. The ends of steam mains are dripped through the float and thermostatic traps into the return main. The return main connects to an accumulator tank equipped with a float control. This accumulator tank must be installed at the lowest point of the return, all of which must gravitate to it. No lifts must be installed in the returns between the accumulator tank and the system.

When the pressure in the steam main exceeds the pressure in the return main by one or two inches of mercury, or the equivalent of eight ounces to one pound, the pump remains idle except when condensation returns to the accumulator tank by gravity and accumulates, causing the float to close the float switch and start the motor when condensate is returned to the boilers. When pressure differential is less than one inch of mercury, the differential controller operates to close a mercury bucket switch, which carries current to close the magnet in the starter. Then the motor operates until a differential of about 2 inches is reached; the pump stops, and, unless the differential falls, it will only start again as accumulation of condensation in the accumulator tank causes the float switch to close, thus starting the motor.

The differential controller comprises a cast iron chamber divided by a rubber diaphragm. The equalizer connections from the steam main are connected to the front chamber. The difference in pressure on either side of the diaphragm moves it away from the greater pressure, with or against the spring on the outside of the housing, and actuates the mercury switch. The return main equalizer is made into the rear chamber. No stuffing boxes are used on the differential controller. A packless feature is used to connect the diaphragm to the switch mechanism.

The equalizers are equipped with a surge chamber 2 inches in diameter. These are required to reduce the difference in head to a minimum as the diaphragm in the controller displaces or takes in water. Since the equalizer connection from the steam main would sooner or later be filled with condensation and impose a head against the diaphragm, it is necessary to fill both with water when starting the system. Plugs are arranged in top of the surge chamber for this purpose. The three-way cock allows setting for operating the system as a vacuum system. Needless to say, all check valves must be tight.

The differential vacuum heating system has been under development for several years. The system was given a laboratory test over a period of five months in a two-storey brick building exposed on three sides, equipped with 1,402 square feet of direct radiation. The results were presented in a paper before the American Society of Heating and Ventilating Engineers at the annual meeting in St. Louis in January 1927.*

The system has practically not any more equipment than is required on a first class vacuum return line system, and has not any complicated controls. The steam requirements can be controlled in the boiler room to meet the demands imposed by varying outside temperatures through the increased range of operating pressure down to sub-atmospheric pressures at which steam can be positively circulated. The differential vacuum system lends itself to temperature control just as readily as any other system of heating, the type of control used varying according to the conditions to be met.

There are a number of these differential systems now in progress of installation throughout Canada, the first one of which was actually put into operation in an apartment house in Montreal the latter part of September.

* See the A.S.H. & V.E. Journal, April 1927.

The Meetings of the International Electrotechnical Commission at Bellagio and Rome and the World Power Conference at Carnobbio

M. J. Murphy, M.E.I.C., Electrical Engineer,
Department of Railways and Canals, Ottawa, Ont.
Ottawa Branch, November 17th, 1927

Bellagio and Carnobbio, on lake Como, are two of the most beautiful places in all Italy. They are twenty miles apart. It was at Como that Allessandro Volta, from whose name the word volt is derived, died in 1827 and the Italians arranged a grand national and international centennial celebration in connection with which five important conventions were held. From the four corners of the earth there gathered physicists, meteorologists, telegraphers and telephone men, World Power Conference and International Electrotechnical Commission delegates to hold conventions near Volta's tomb and to visit the great exhibition at Como. Mr. Murphy passed around a very beautiful medallion struck in commemoration of Volta's centenary; it is a very fine example of Italian art.

He spoke briefly of some of the major items on the agenda at both meetings. The conventions around lake Como lasted for ten days, after which there was a trip to the principal cities of Italy on a special complimentary train provided by the Minister of Railways. The Italians lavishly entertained the visitors at each of these places. Magnificent receptions, luncheons and banquets were tendered by the Italians' committees and by governmental and civic officials. Mr. Murphy paid a great tribute to the perfect efficiency of the Italians and to their unbounded hospitality.

On the agenda of the International Electrotechnical Commission were such things as nomenclature, rating of electrical machinery, terminal markings, symbols and other standardization matter calculated to bring uniformity in all countries or, as the speaker said, aiming at calling "a spade a spade." They also considered safety regulations for overhead lines, a matter in which Canada stood above all other countries. The rating of rivers was another most important matter on which the "secretariat" had been entrusted to the American Advisory Committee, upon which forty engineers had been engaged in the United States.

Official delegates to the International Electrotechnical Commission numbered 199, of whom 40 were from Great Britain, 36 from Italy, 21 from the United States, 17 from France, 15 from Germany, dwindling down to one from Canada. Fifty ladies from foreign countries accompanied the delegates. The American delegation was well organized and split up in such fashion that voting delegates, secretaries and official reporters were assigned to each section,—five sectional meetings were often held at the same time. The speaker humorously remarked that it was not possible to so efficiently organize Canada's official delegation, (of one),—he was also supposed to be attending the World's Power Conference at Carnobbio, twenty miles away from Bellagio, at the same time. Mr. Murphy said that he would be only too pleased to supply information on the work accomplished at these conferences, from the printed reports, to those who wanted it.

Among the important items dealt with at the World's Power Conference were the international situation, standardization of water power data, national and international interconnection of power systems,—including the export of power, international co-operation and many engineering phases in the development of power. One important outcome of the Basle meeting of 1926 has been the suggestion regarding the gathering of power statistics for each country in such a way as to be readily comparable.

At the opening banquet of welcome to the International Electrotechnical Commission, Canada was highly honoured, Mr. Murphy said, by the selection of its delegate to thank the Italians on behalf of the visiting delegates from all the other countries. Canada and the United States, to judge from Mr. Murphy's remarks, were a never-ending wonder to the foreign delegates. They could not believe that on this continent there was a three-thousand-mile boundary line along which there was not even a pea shooter or a pop gun. That fact, Mr. Murphy explained, was due to the people on this continent freely intermingling, meeting every day and understanding each other. In such gatherings as those around lake Como, Mr. Murphy saw the further knocking down of international barriers, and he knew that much good would result from them.

He found many triumphs of engineering in Italy; the Italians are not only right up-to-date, but they lead in some engineering matters. At Larderello, in the Apennine mountains, Prince Conti and his associates are producing 6,000 k.w. in a fuelless steam power house where the steam comes out of the bowels of the earth. He was especially interested in the great Pirelli works in Milan, where there are 19,000 employees and where the delegates were shown how cable to carry 132,000 volts underground was manufactured for use in the streets of New York and Chicago.

Senator Pirelli, at luncheon in the great works established by his father in 1872, welcomed the delegates in perfect English, French, German and Italian. He was a member of the recent Financial Commission to the United States. "Of such fibre," said the speaker, "are Italy's present captains of industry made."

The Italian power houses, the speaker said, are works of art; artistic design, he was told by Mr. Semenza, cost them only two per cent extra, and they thought it worth while over there. A pleasant feature of the trip was the riding in trains drawn by electric locomotives in Switzerland, France and Italy,—no dust, no dirt and no coal required. Thousands of miles of railway in those countries are being electrified.

Delegates from many countries repeatedly referred to their interesting trip through Niagara Falls, Toronto, Ottawa, Chelsea and Montreal in 1926, and to the kindness of their Canadian confreres at that time. The official reception in the Parliament Buildings at Ottawa, where they were welcomed by the Hon. Rodolphe Lemieux, the speaker of the House of Commons, stood out in their memories above everything that happened on this continent.

"To visit Italy at any time is a rare treat," said the speaker. "But to be continually attended throughout that beautiful country for nearly a whole month by its distinguished engineers and scientists and their families,—assisted and encouraged by everyone in authority, from Premier Mussolini down to the trainmen,—is, or was, a wonderful experience to which, on this occasion, justice cannot be done.

"Visitors are struck with the happiness of the people, the cleanliness of the cities, their orderliness, the hum of the industrial establishments and the great number of travellers on the trains,—all striking evidences of good times in Italy. The present administration seems to have re-awakened Italy to her past glories and future possibilities."

International Electrotechnical Commission Meeting at Bellagio, Italy

The Agenda for the 1927 meeting of the International Electrotechnical Commission was as follows:—

Reports of National Advisory Committees:—

No. 1 —Nomeclature.
" 2 —Rating of Electrical Machinery.
" 2*a*—Terminal Markings.
" 3 —Symbols.
" 4 —Prime Movers.
" 4*a*—Steam Turbines.
" 6 —Lamp Caps and Sockets.
" 8 —Voltages.
" 9 —Traction Motors.
" 10 —Insulating Oils.
" 11 —Safety Regulations for Overhead Lines.
" 12 —Radio Valves.
" 13 —Measuring Instruments, (Meters).
" 14 —Rating of Rivers. The American *Advisory Committee,*—the home committee working as the Secretariat,—was made up of 40 engineers, as follows:—independent consulting engineers, 9; federal agencies, 4; constructing, financing and management interests, 18; manufacturing interests, 3; states and municipalities, 6.

World Power Conference at Carnobbio, Italy

The Agenda of the 1927 meeting was as follows:—

(1) The International Situation.
(2) Standardization of Water Power Data.
(3) Transactions at the Basle meeting in 1926, and business arising therefrom:—
 (a) Dams.
 (b) Turbine efficiency.
 (c) Statistics on electric power production.
 (d) Influence of dams on the transport and deposit of solid matter.
 (e) Uniform method of determining the Constant in Chazy's formula of velocity of water in conduits.
 (f) Laws on water power development.
 (g) Electricity in agriculture.
 (h) Statistics of power resources of each country,—so compiled as to be readily comparable.
 (i) National and International interconnection of power systems.
(4) International Co-operation.
(5) The Constitution.
(6) The Central Office of the World Power Conference.
(7) The Volta Solemn Commemoration.
(8) Publicity.
(9) Research.
(10) Fuel Conference in London in 1928.
(11) Communication regarding International *Engineering* Congress in Japan in 1929 and holding a sectional meeting there.
(12) Date and Place of *Second World Power Conference*, Germany 1930. (First at Wembley.)
(13) Date and Place of next *Council* meeting, Barcelona in spring of 1929.

Recent Additions to the Library

Proceedings, Transactions, etc.

Presented by the Societies:
The Liverpool Engineering Society: Transactions 1927.
The Iron and Steel Institute: Charter, By-Laws and List of Members and Associates.
The Institution of Mining and Metallurgy: Transactions 1925-1926.
The Institution of Mechanical Engineers: Proceedings 1927.
The Association of Professional Engineers of Alberta: Act, By-Laws and List of Members 1927-1928.
The Association of Professional Engineers of British Columbia: Engineering Act 1927.
The Association of Professional Engineers of Ontario: Act of Incorporation, By-Laws, Code of Ethics and List of Members 1926.
The Corporation of Professional Engineers of Quebec: List of Members 1927.
The Institution of Civil Engineers: Sessional Notices 1927-1928.
The Punjab Engineering Congress: Minutes of Proceedings 1919-1927.
The Western Society of Engineers: Year Book 1927.
The American Society of Civil Engineers: Transactions 1927.
The American Society for Testing Materials: Tentative Standards 1927, Index to Proceedings 1921-1927.
The North East Coast Institution of Engineers and Shipbuilders: Report of Council 1926-1927.

Reports, etc.

Department of Mines, Canada:
Mines Branch, Investigations of Fuels and Fuel Testing 1925.

Department of Trade and Commerce:
Bureau of Statistics, Summary Trade of Canada, Trade of Canada with the United States.

Canadian Engineering Standards Association:
Canadian Electrical Codes, Pt. 1, Control Cable for Electrical Power Plant Equipment, Movable Bridges.

University of Alberta, Edmonton:
Industrial Research Department, Bituminous Sands of Alberta.

American Engineering Standards Committee:
The Status of National Safety Codes PS 262.

Smithsonian Institution:
Annual Report 1926.

The Institution of Engineers, Australia:
Pressure Exerted on Retaining Walls by Materials Possessing Some Cohesive Strength, Some Investigations into Ventilation of Sewers and Deodorization of Sewer Gases, Motor Transport, Notes on the Destruction of Wharf Piles by Crustacæ and Mollusca in Australian Harbours, Practical Proportioning and Control of Concrete Mixtures.

University of Iowa:
Extension Bulletin, Bulletin 170. Proceedings of the Iowa Power Conference.

Technical Books, etc.

Presented by John Wiley & Sons:
Machine Design Drawing Room Problems, by C. D. Albert.

Presented by The Williams and Wilkins Company:
The Mathematics of Engineering, by Ralph E. Root.

Presented by D. Van Nostrand Company:
Theory of Vibrating Systems and Sound, by Karl K. Darrow.
Introduction to Contemporary Physics, by Irving B. Crandall.

Presented by McGraw-Hill Book Company:
Principles of Chemical Engineering, by W. H. Walker, W. K. Lewis, W. H. McAdams.

Presented by The Oswego Harbour and Dock Commission:
Great Lakes Commerce and Port of Oswego, New York.

BOOK REVIEWS

Concrete Building Construction

By Theodore Crane. Edited by the late Thomas Nolan. John Wiley & Sons, Inc., New York, 1927. Leather, 6 x 9 in., 689 pp., figs., tables, dgrms., $6.00.

In this volume, Professor Crane has endeavoured to set forth concisely the most useful information for designers and constructors of reinforced concrete in building work. The primary idea appears to have been to present in a single volume only the material most needed by those engaged in this type of construction. Consequently, the theoretical treatment is not so elaborate or so detailed as in some other works on reinforced concrete, but, nevertheless, the essentials of the ordinary problems of structural design in reinforced concrete have been well set forth.

Chapters are devoted to the subjects of General Considerations in Building Design; Fundamental Principles and Formulas; Bending Moments; Shear, Diagonal Tension and Bond; Design of Beams and Slabs; Continuous Beams and Building Frames; Bending and Direct Compression; Columns; Footings; Girderless Floors; Combination Floor Systems; Stairs, Walls, Parapets and Cornices; Roofing, Flashing and Waterproofing; Estimating; Proposal Letters and General Contracts; Purchasing Materials, Sub-Contracts; Cost Accounting; Forms for Contract; Reinforcement; Concrete; Finishing Concrete Surfaces; Appendix.

A single-volume work covering the great variety of subjects comprised in this book will naturally appeal most to those who do not need to go very profoundly into either design or construction in reinforced concrete. For the class of reader for which the book was evidently designed, it should be a very useful and valuable acquisition. Those needing supplemental information can readily secure it from other and more elaborate works.

C. R. Young, M.E.I.C.
Professor of Structural Engineering,
University of Toronto, Toronto, Ont.

Machine Design Drawing Room Problems

By C. D. Albert, M.E. John Wiley & Sons, New York, 1927, Second Edition. Cloth, 6 x 9 in., 355 pp., figs, tables, $3.00.

This book, published in July, is the second edition of a work which first appeared in 1923, the author being professor of machine design in Cornell University. It is primarily a college text book, and has been written more from the professor's viewpoint than from that of the practising engineer. Of the ten chapters, the first three are general, while each of the last seven contains a specific problem.

Chapter I gives a great deal of general information and many tables, such as tolerances, bearing pressures, gear ratios and a number of formulæ covering many of the problems met in machine design. The next chapter deals with materials used in machines, and discusses at some length the properties of these materials, giving also tables of compositions of bronzes and other alloys, with useful information and tables with reference to steel, etc. The third chapter is entitled "Factor of Safety and Allowable Stress," and is explained by its title. These three chapters, occupying one hundred and fifty-two pages, are very valuable, and it is most helpful to find the information so well classified.

The remainder of the work is taken up with separate problems, seven of which have been discussed in as many chapters. In each case the chapter opens with a general discussion of the problem, and with illustrations of several machines where possible. The specific problem is then stated and solved, and the chapter concludes with a list of drawings required and the estimated time required to complete each one.

One chapter will be dealt with in some detail to explain the method. Chapter VII is entitled "Combination Punch and Shear," and ten photograph cuts of different machines and their parts are given, along with a table of commercial data on machines made by two companies. The specifications next being stated, the author deals with the mechanics of the shafts, sliding block, frame, clutch, flywheel and belt pulleys, and the complete method of design is fully laid down.

In addition to the punch, the later chapters deal with pumps, slide valves, flywheels, drilling machines, jib cranes and balancing. The illustrations are complete and well made, and the make-up of the book is quite up to the publishers' standard. While the book is mainly for students, others should find much of the material in it very valuable.

Robert W. Angus, M.E.I.C.
Professor of Mechanical Engineering, University of Toronto, Toronto, Ont.

Standards and Tests for Reagents and C.P. Chemicals

By Benjamin L. Murray. D. Van Nostrand Company, Inc., 1927, Second Edition. Buckram, 6 x 9 in., 560 pp., tables, $5.00.

The following extracts from the prefaces to the first and second editions should serve to show the purpose of this book:—

"It describes and standardizes the more important testing chemicals used today in factory and other laboratories, particularly those produced successfully on a commercial scale."

"Rather full descriptions of the physical properties of chemicals, action of light and air, precautions to be observed in storing, statement of uses, etc., are made."

"A new and extensive feature embraces the field of C. P. Chemicals. These have now been added to the test standards of purity and methods of testing for somewhat over two hundred C. P. Chemicals."

Almost every chemist is required at times to test his reagents and other chemicals. It is on such occasions that the necessity for a work of this kind is felt. The book is clearly written, well printed and bound, and the methods easy to follow.

It is a book which the analytical chemist and probably others will find it hard to do without.

F. M. G. Johnson.
Professor of Chemistry, McGill University, Montreal, Que.

Phosphoric Acid, Phosphates and Phosphatic Fertilizers

By Waggaman and Easterwood. The Chemical Catalog Company, New York, 1927. Cloth, 6 x 9 in., 370 pp., tables, figs., illus.

This book, which is one of the series of monographs being published by the American Chemical Society on technical subjects, treats of the more important compounds of phosphorus. When we consider the prominent part played by phosphoric acid in animal and plant life alone, it is realized that the subject is of prime importance.

The authors cover the ground very thoroughly, starting with the chemistry and passing on to the mining and the various methods of preparation for commercial use. Two chapters are devoted to the commercially important deposits of the world, the first to those of the United States. Following are four chapters on the methods of manufacturing available phosphates, water soluble phosphates and phosphoric acid. The last of these chapters, which is on the volatilization process for producing phosphoric acid, is of particular interest. It reviews a vast amount of research and indicates great possibilities.

The last three chapters describe some of the more common uses of phosphates, and give notes on special preparation in respect to each case.

Numerous references are given to both the literature and patented processes, and in the last forty-odd pages are listed the United States patents with regard to methods of manufacture.

For a number of years, Canada did a considerable business in phosphates. Since the discovery of the amorphous deposits in the United States, however, the mining of apatite in Canada has ceased. It occurs to the writer that with research in the direction of the volatilization process, and the increase for demand in fertilizer that must come in Canada, this condition may change.

In case our readers are not familiar with the object of the American Chemical Society monographs, it may be well to state that the society is engaged in the production of a series of books on chemical subjects, with two particular ideas in view. The first is to gather and arrange in a form, readable by others than those directly interested, the available information on the subject. The second purpose is to promote research.

The authors are to be congratulated on amply fulfilling the first of these purposes, and such volumes as that now reviewed will do much to suggest and encourage investigation.

C. K. McLeod, A.M.E.I.C.
Busfield, McLeod, Limited, Montreal, Que.

The Rayon Industry

By M. H. Avram. D. Van Nostrand Company, New York, 1927. Buckram, 6 x 9 in., 922 pp., illus., $10.00.

A complete survey and a well compiled history of the rayon industry is made available to the technical man and to the general public through this book.

The economics of rayon production are given in detail, while there is also considerable information concerning the financial structure and ramifications of the industry.

In treating the various processes, the author does not enter very deeply into their chemical side, but devotes considerable space to the mechanical appliances involved.

The book is well illustrated and describes the manner in which rayon is produced, whence its raw materials are obtained and the great future before this comparatively new industry.

E. Parke Cameron, A.M.E.I.C.
Director, Division of Pulp and Paper, Forest Products Laboratories of Canada, Montreal, Que.

EMPLOYMENT BUREAU

Situations Vacant

Mechanical Engineer

Graduate mechanical engineer with several years experience, familiar with hydro-electric plant and layout, for office engineering. Location, Toronto. Give full particulars of education, experience, salary required. Apply Box 177-V, The Engineering Journal.

Chief Electrical Engineer

The Government of Ceylon invite application for a chief engineer to take immediate charge of and responsibility for the government's electrical undertakings.

The government have under construction a steam generating station, and a system of distribution in Colombo, and also hydro-electric power works designed to supply Colombo and district in the first instance; afterwards to be extended for general supply purposes.

Qualifications desired: Good administrative ability; experience of power distribution in urban and rural districts; hydro-electric power construction.

Period of engagement, three or five years in first instance.

Free quarters will be provided in Colombo.

Government will pay cost of ocean passage to Ceylon of selected candidate and family.

Candidates to state age, qualifications, experience and salary required.

Applications to be forwarded on or before February 1st to the Crown Agents for the Colonies, 4, Millbank, London, S.W. 1.

Situations Wanted

Mechanical Engineer

Graduate mechanical engineer seeking engineering, industrial, or financial connection in Quebec or Ontario. Six years' experience in mill maintenance, cost studies, cost finding, estimating, budgeting and supervising construction. Familiar with accounting, industrial and financial organization. Salary to start is a secondary matter. Apply Box No. 229-W, The Engineering Journal.

Mechanical Engineer

Graduate mechanical engineer with some experience on survey and construction work, also three years on mechanical staffs of pulp and paper mills, desires to make new connection. Apply Box 230-W, The Engineering Journal.

BRANCH NEWS

Student Section of Vancouver Branch

The first meeting of the Student Section of the Vancouver Branch of The Institute was held on October 19th, at which about one hundred students were present.

The meeting was presided over by W. Brand Young, A.M.E.I.C., vice-chairman of the Vancouver Branch, and E. A. Wheatley, A.M.E.I.C., registrar of the Association of Professional Engineers of British Columbia.

Mr. Young outlined the organization and functions of The Institute and pointed out the desirability of students affiliating themselves with The Institute, which is the national body of the engineering profession. He also outlined the requirements for membership in The Institute and some of the advantages and privileges resulting from such membership.

Mr. Wheatley explained the functions of the Association of Professional Engineers as a provincial body, as compared with the larger and Dominion-wide organization of The Institute, and in the course of his remarks outlined the work of each organization.

The officers of the Student Section are as follows:—J. Terry North, Jr., S.E.I.C., president, and J. H. Legg, S.E.I.C., secretary-treasurer.

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

One of the most successful "first nights" of the season that the local branch has ever staged was put on October 27th, when the ball room of the Palliser hotel resounded to the strains of dance orchestra and the gliding of many feet. Light and fantastic terpsichorean movements of the members and lady guests were indulged in to hearts' content. Everyone expressed themselves as having had a most enjoyable time when the evening closed all too soon for most of those present.

As each lady entered the room, a fluffy favour in the shape of a cat, dog, squirrel, etc., was presented which was the cause of much amusement. The ball room was effectively illuminated with coloured flood lights which, with suspended balloons, added an air of gaiety to the occasion. A conspicuous feature was a large shield displaying the crest of The Institute and outlined with delicately-hued lamps. Supper-time produced a spirit of hilarity which was enhanced by the adornment of vari-coloured caps. The average age of all assembled was seemingly exceptionally low for an engineering gathering. From the general atmosphere of jollity, one would have cause to doubt that there was such a being as an elderly engineer !

Our secretary had discarded that worried look that had been in evidence for many days prior to the occasion, and smiled the smile of one relieved of much weight on the shoulders. The fact that all, without exception, seemed to enjoy themselves thoroughly was an incentive to include more social activities in the year's functions.

Kingston Branch

G. J. Smith, A.M.E.I.C., Secretary-Treasurer.

A well attended meeting of the Kingston Branch was held in Carruthers Hall, Queen's University, on October 18th to hear an address by Mr. M. W. Shears, heating engineer of the C. A. Dunham Company, Limited, Toronto, on "The Differential Vacuum System of Steam Heating." Prof. L. T. Rutledge, M.E.I.C., chairman of the branch, occupied the chair, and at the close of the meeting a vote of thanks was moved by Prof. W. L. Malcolm, M.E.I.C.

Mr. Shears, by means of a number of slides, fully explained the principles and operation of the differential vacuum system of heating and showed that the use of the system greatly increased the efficiency of the plants with which it was used and at the same time considerably lowered the fuel cost.

The whole paper proved most instructive to the members of the branch and the large number of engineering students present. A summary of the address appears on another page of this issue.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

The Autobiography of the Earth

An extremely interesting and instructive lecture was given before the branch at a supper-meeting held on October 28th by Prof. H. W. McKiel, M.E.I.C., of Mount Allison University, on "The Autobiography of the Earth."

Written history can carry us back only a few thousand years, but the knowledge obtained by geologists from rocks and fossil remains provides an historical account of the development of the earth and its people extending over a period of some fourteen hundred million years. Not only is it possible to learn of the physical changes through which this planet has passed, but also to gain an intimate knowledge of the living creatures that have at various periods inhabited the earth. Prof. McKiel's address was profusely illustrated. Maps were shown depicting the earth's surface as it existed in early times, together with drawings of prehistoric animals, birds and fishes. Members viewed with considerable interest, and little pride, pictures purporting to represent the early ancestors of our noble selves. In closing, the speaker pointed out that of all the animals of unsurpassed ferocity and size that roamed and ruled the earth some fifty million years ago none now remained. All had given way to man, who, while miserably inferior to them in physical strength and stature, had what they had not,—superior power of brain, which then, as now, was the deciding factor in the struggle for existence.

A hearty vote of thanks, moved by A. S. Gunn, A.M.E.I.C., and seconded by E. T. Cain, A.M.E.I.C., was tendered Prof. McKiel by the chairman.

During the course of the supper, vocal solos rendered by Mr. A. Lorne McKendrick and clarionet selections by Dr. F. E. Burden were greatly enjoyed by the members present.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

The Manufacture of Ball and Roller Bearings

In the unavoidable absence of Gordon Janes, M.E.I.C., vice-president, Canadian S.K.F. Company, Limited, on October 27th, his most interesting and illuminating paper on the "Manufacture of Ball and Roller Bearings" was ably presented to the Montreal Branch by Mr. R. F. Runge, factory manager of that company.

The general manufacturing operations and the rigid inspection employed in producing these extremely precise bearings were described on pages 487-493 of the November number of The Journal.

The chairman, F. Newell, M.E.I.C., in opening the meeting expressed to the members the belief that the extreme accuracy of these anti-friction bearings ranked with the development of heat treatment and alloy steels as the greatest advances of mechanical engineering in the present century.

Following the interesting discussion opened by C. O. Thomas, A.M.E.I.C., Dr. R. A. Ross, M.E.I.C., past president, while commenting on this romance of modern engineering which surpassed in precision even the marvelous production of a watchmaker's skill, expressed to the speaker and author the appreciation of the meeting.

Special Branch Meeting

On November 3rd the Montreal Branch, at a special business meeting prior to the presentation of the evening's paper, appointed F. A. Combe, M.E.I.C., F. S. Heward, A.M.E.I.C., and G. E. Templeman, A.M.E.I.C., as a committee to nominate executive officers for the year 1928. The branch chairman, C. V. Christie, M.E.I.C., presided.

The Manufacture of High Pressure Boilers

The tremendous progress that has been achieved in the art of boiler construction during the past few years was strikingly shown in a paper on the "Manufacture of High Pressure Boilers," presented to the branch on November 3rd by J. O. Twinberrow, A.M.E.I.C., assistant chief engineer of Messrs. Babcock-Wilcox & Goldie, McCulloch, Limited.

In quoting many instances of the rapid increase in boiler pressure to 1,400 lbs. per square inch, the speaker indicated corresponding advantages in the processes of manufacture.

These advances were vividly illustrated in a four-reel film admirably depicting this revolution in steam plant production.

The opening reel of this film revealed the details of a model steam plant in action, by means of a clever and ingenious working diagram. Steam appeared to pulsate through the boiler tubes, up the headers and around the superheating circuit in a most realistic manner, while coal flowed through the furnace on a chain grate to the ash pit at a most alarming rate. To make these high pressures possible, great sheets of steel up to five inches in thickness were mechanically formed into drums on huge presses. Giant rivets were cold rolled, rumbled and accurately ground prior to use.

The following reel illustrated rivet holes being quickly pierced in the drum plate by a multiple drilling machine. Butt straps and nozzles were applied, end plates formed and drilled and powerful caulking machines were presented in action on the inside of the drum.

The third reel showed the manufacture of the headers, bent, machined and finally drilled in multiple spindle machines.

In the concluding reel of this most interesting film, the sections were shown being assembled, the tubes expanded and the careful inspection of the finished product.

In the intervals the speaker described the development of these high pressure units, referring particularly to the problem of refractory linings for the furnaces. The water wall used consists of cast iron blocks bolted together and to water cooling tubes, while protected on the furnace side by thin refractory surfaces. The introduction of this water wall had permitted higher temperatures in the furnaces and at the same time enabled the supply of air to the burning fuel to be kept under control at all times.

In conclusion the speaker emphasized the necessity of designing each boiler unit to suit the conditions which would govern its operation.

In the discussion which followed, F. A. Combe, M.E.I.C., and John T. Farmer, M.E.I.C., took a leading part, the latter commenting in particular on the pleasant freedom of the film from the discomforts of noise and heat usually associated with boiler manufacture.

During the evening Mr. E. Priestman, representing the British Engineering Association, offered the services of that body to all importers of engineering equipment from Great Britain. The association had been successful in solving many problems, while its members had benefitted greatly in their relations with labour by the introduction of a form of profit-sharing based on total production over and above certain fixed quantities.

F. S. B. Heward, A.M.E.I.C., the chairman of the evening, expressed the appreciation of the meeting to the speakers.

Meeting of October 20th

"The Sub-structure of the Buctouche River Bridge" was the title of a paper read by Major C. S. G. Rogers, A.M.E.I.C., bridge engineer, Atlantic region, Canadian National Railways, at a meeting on October 20th, of which J. A. Ellis, A.M.E.I.C., was the chairman.

The paper dealt, in a most interesting manner, with the repairs and replacement of the old bridge, situated at the mouth of the Buctouche river, on a small branch of the Canadian National Railways in New Brunswick. The author not only described the engineering difficulties that had to be overcome in replacing the bridge at a reasonable cost, but gave some very interesting entomological information in regard to the destructive power of the toredo navalis or shipworm and other bugs of a like nature on timber, which prevents the use of this material for construction purposes in these coastal waters without some special protection.

After a short discussion, A. R. Ketterson, A.M.E.I.C., moved a hearty vote of thanks to the speaker.

Montreal Tramways

On Thursday evening, November 19th, the members of the Montreal Branch were fortunate in hearing a paper on the subject of the Montreal Tramways, read by Judge Saint Cyr, the chairman of the Montreal Tramways Commission.

In introducing the speaker, the chairman of the meeting, O. O. Lefebvre, M.E.I.C., gave a short history of Judge St. Cyr's career, mentioning that he was made a judge before the age of forty, and appointed chairman of the Tramways Commission at its inception in 1918.

In his opening remarks, Judge St. Cyr referred to the introduction of the electric tramways service in 1892, thirty-one years after the first appearance of tramways in the city.

The paper is published in full in another section of this issue of the Journal.

In a short discussion on the paper, A. C. Tagge, M.E.I.C., president of the Canada Cement Company, proposed a hearty vote of thanks to the speaker for his interesting paper.

Niagara Peninsula Branch

Walter Jackson, M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

A joint meeting was held by Niagara frontier section of the American Institute of Electrical Engineers and Niagara Peninsula Branch of The Institute at St. Catharines on October 28th, together with representatives from the Toronto section A.I.E.E., the Toronto Branch A.S.M.E., and the Engineering Society of Buffalo. The attendance at dinner was 300, while the attendance at the collegiate auditorium in the evening was 700.

It may be of interest to record some of the events which preceded such a notable gathering of engineers. The suggestion that a trip over the Welland ship canal to record progress would be interesting to our members was supplemented by a move to invite members from the adjoining branches to participate.

It was to be nothing out of the ordinary, perhaps twenty or thirty visitors and fifty or sixty residents with a dinner meeting at the end of the day and an early adjournment to allow visitors plenty of time in which to motor home. But the local members of the A.I.E.E. heard that the date of the proposed meeting corresponded with that which they had already set for their convention, and proposed a joint meeting.

About a hundred members of The Institute came from the neighbouring branches of Toronto, Hamilton, Peterborough, London, Brantford, etc., and many of them motored directely to Port Colborne, where the inspection was to commence about 9.30 a.m. with a boat trip around the harbour and out to the new concrete crib breakwater. Then northward along the canal to lock No. 8, which is some 1,300 feet long and used for regulating the canal summit level against the fluctuations of lake Erie, past the giant hydraulic dredges excavating the prism of the summit level and a hasty glimpse of the inverted syphon culvert for the waters of Chippawa creek, before luncheon at Welland.

The other members of the party were met at Thorold about 1.30 p.m., and the party then visited the immense twin flight locks which lead over the Niagara escarpment. Travelling northward down towards lake Ontario the members of the party saw evidences of work completed; locks Nos. 3, 2 and 1 practically finished, with the exception of the operating machinery, and some of the steel lock gates which are in the course of erection. Bridge No. 3, an eighty-foot span rolling lift, was operated for the benefit of the visitors, as was also the Stoney gates of the weir and the intake Taintor valves at Port Weller.

E. G. Cameron, A.M.E.I.C., assistant engineer of the canal, was in charge of arrangements and should be heartily congratulated upon the success which attended his efforts.

Chairman Carl E. Scheman, M.E.I.C., presided at dinner, after which an early adjournment was made to the collegiate auditorium. This part of the programme was in charge of the A.I.E.E. officers, Mr. J. A. Johnson and Mr. C. E. Sissons, who acted as chairman.

On behalf of his worship Mayor Smith, Major Hugh Bell welcomed the gathering to the city of St. Catharines. The speakers at the evening session were A. J. Grant, M.E.I.C., engineer-in-charge of the Welland ship canal; F. D. Corey, Buffalo, Niagara and Eastern Power Corporation; H. G. Acres, M.E.I.C., consulting engineer, and E. P. Lupfer, chief engineer of the Peace bridge.

Mr. Grant gave a brief outline of the canal systems of Canada leading to the construction of the first Welland canal in 1919. The history of the canals, he said, has been one of constant reconstruction and enlargement to meet the increasing needs of navigation. Work on the ship canal had started in 1913, but was discontinued during the war. A number of highly interesting slides showed various phases and details of construction, emphasizing the fact that the canal is now about 80 per cent completed with an expenditure of about $84,000,000. If there are no unforeseen delays, locks 1, 2 and 3 will be complete in 1929, and that section below the escarpment may be put into operation about 1930.

The tonnage on the St. Lawrence-Welland canals has steadily increased from 1,000,000 tons in 1903 to an estimated amount of about 7,000,000 tons in the present year.

Save Niagara Falls

Mr. Corey spoke of the past, present and future of this titanic power and scenic resource. About 94 per cent of the water from the Niagara river goes over the Canadian, or Horseshoe falls, and the main part of this stream is concentrated at one small section where the erosion is excessive. Studies have been made of this condition, and from an engineering standpoint it is quite feasible to correct the evil. The flow can be spread more evenly along the ledge, thus increasing the beauty while at the same time decreasing the rate of erosion, and then probably there will be a surplus of water which might be used for power purposes.

The Peace Bridge

Mr. Lupfer wished to emphasize the symbolic feature of this link between Canada and the United States. It was not undertaken in the spirit of commercial enterprise. As soon as the bonded debt is retired the bridge will be handed over and become the joint property of Canada and the State of New York. It should be possible to pay off this debt within a period of twelve years. During the first five months of this year the entire carrying charges for the year were earned. About 1,100,000 cars and 6,000,000 people have already passed over the bridge, and Mr. Lupfer foresees a traffic of 3,000,000 cars and 10,000,000 to 12,000,000 people annually.

St. Lawrence Power

Mr. Acres spoke of the possibility of developing St. Lawrence power in the immediate future and leaving the canalization until some later date. His address is given in full in another part of this issue.

Thus ended a very successful meeting.

Amendments to Branch By-laws

On October 9th, at Thorold, a business meeting was held to discuss the advisability of making certain changes in by-laws relating to the election of officers.

Past executives had experienced difficulty in fulfilling the requirements of the present by-laws, particularly that one which compelled a double nomination for the position of secretary-treasurer. It was recognized that a good secretary-treasurer is the mainstay of a branch, and therefore a continuance in office over a period of years was highly desirable.

A committee, consisting of E. G. Cameron, A.M.E.I.C., vice-chairman; Alex. Milne, A.M.E.I.C., past chairman; R. W. Downie, A.M.E.I.C., past secretary, and C. G. Moon, A.M.E.I.C., was appointed to study this question.

They recommended that the Executive Committee be enlarged in order that this branch, which covers a large area, might be fully represented from all districts. As meetings of the branch are generally held at the larger centres, such as St. Catharines, Welland, or Niagara Falls, it was considered advisable that outlying districts should have an equal representation, firstly, in order that at least one executive should be able to attend all meetings, and secondly, with the belief that such action would tend to stimulate added interest within such districts.

It was recommended that the choice of a chairman and vice-chairman be left to the executive and that the position of secretary-treasurer be appointive instead of elective. Further, that the election be held at some date previous to the annual meeting in order to avoid that hiatus which generally occurs while ballots are being counted.

The meeting showed great interest in these proposals. After a thorough discussion they were passed unanimously.

Automatic Traffic Control

Through the courtesy of the Canadian General Electric Company, Mr. R. M. Love, street lighting specialist, gave an illustrated address on the above subject at Niagara Falls on November 16th.

Mr. Love reviewed the difficulties which have been encountered in all large cities on account of the growth of automobile traffic and gave a clear idea of the lines along which they are now working in Toronto.

The latest is that known as the "co-ordinated progressive system," in which the green lights at intersections along any street will show in rotation; the interval of time between one intersection and the next being that which is necessary to cover the distance at a reasonable driving speed.

Thus it is hoped to control the excessive speed which is sometimes indulged in to "beat" the light, for if a driver exceeds the reasonable limit then he will be compelled to stop at every corner, whereas if he keeps within the limit then the way will be clear along the whole street.

Toronto finds that the best practice is to have these signals working for the twenty-four hours rather than try to change to a cautionary flash-and-go system at night. The cost is trifling, as the lights are only 60-watt.

The amber lens is not used in Toronto, a short dark period between the red and the green lights being preferred. The third light, usually amber, is now a red "fire-light," being lighted from a central station on any alarm of fire and darkened by the local traffic policeman as soon as the street is clear of engines.

The new signals cost about $170 each installed, or say $700 for one intersection. With an expenditure of roughly $12,000 in the downtown section, Toronto was able to reduce the traffic force in that district from thirteen men to four men.

Discussion on this address was general, everyone was more or less affected, and the speaker answered many questions as to the practice in various cities. Every city appeared to be trying to solve the matter in a different way, and visiting motorists were generally hopelessly bewildered to the detriment of careful driving.

T. Scott, M.E.I.C., remarked that this problem appeared to him to be a matter for engineering study. Instead it had devolved upon the police department to find solutions. This, he considered, was not quite fair to the police. They were magnificently equipped to handle the enforcement of regulations, but these regulations should only be made after a thorough study which the police were not in a position to make. The question of lack of standardization, both in Canada and the States, was acute and some effort should be made immediately to improve conditions. He wished to move that the branch appoint a committee which would report upon this matter. The motion was readily endorsed by the meeting and Mr. Scott appointed chairman, with the balance of the committee to be appointed at a later date upon his recommendation.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

The first luncheon of the Ottawa Branch for the fall and winter season was held at the Chateau Laurier on October 27th, and was very largely attended, about hundred and forty branch members, out-of-town members of The Institute and guests being present. G. Gordon Gale, M.SC., M.E.I.C., vice-president and general manager of the Gatineau Power Company, was scheduled to address the members on "Recent Power Developments in Ottawa Vicinity." Unfortunately, Mr. Gale was unavoidably detained out of town, and Walter Blue, A.M.E.I.C., manager of development for the Gatineau Power Company, capably substituted on very short notice.

Introduced by Naulon Cauchon, M.E.I.C., chairman of the Ottawa Branch, Mr. Blue gave a comprehensive outline of the extensive developments which have been and are being carried out in the Gatineau valley. An abstract of this address appears elsewhere in this issue.

Workability in Concrete

On Tuesday evening, November 8th, Col. H. C. Boyden, B.SC., C.E., formerly dean of the College of Engineering, Ohio Northern University, addressed the members of the Ottawa Branch at a meeting held in the University Club. Col. Boyden, who is well known to members through his previous lectures under the auspices of the Portland Cement Association, chose as his subject on this occasion, "Workability in Concrete, with Particular Reference to the Use of Diatomaceous Silica."

Col. Boyden told his audience that the latest development in concrete engineering is in the use of diatomaceous silica,—the remains of the earliest forms of life on this planet,—with cement in creating a mixture with improved properties. "Celite," the form in which diatomaceous silica is sold when added to the cement to the extent of, say, two or three per cent, greatly increased the workability of the concrete mixture and added to its bulk, so that construction costs were lowered. When this material is used, Col. Boyden claimed that concrete could be hauled as much as nine to eleven miles and landed at the work in quite workable condition. Because of this quality of great workability in Celite concrete, the speaker claimed that central mixing plants were becoming the vogue in many parts of the United States.

Great workability in concrete, Col. Boyden showed by a series of lantern slides, also resulted in structures of improved quality and beauty. He showed the audience many examples of concrete structures embellished with artistic designs which had been accomplished through the use of diatomaceous silica in the concrete, resulting in perfect structures which did not require any trowel work when the forms were removed.

J. Leslie Rannie, M.E.I.C., presided in the absence of Naulon Cauchon, M.E.I.C., chairman of the branch. A great many questions were asked, showing the interest which the Ottawa engineers took in the subject, and at the conclusion light refreshments were served.

At the Chateau Laurier on Thursday, November 17th, the members of the Ottawa Branch had the pleasure of listening to John Murphy, M.E.I.C., electrical engineer for the Department of Railways and Canals and for the Railway Commission, in an after-luncheon address entitled "My Trip to Italy in 1927." Mr. Murphy was Canada's official delegate to the meetings of the International Electrotechnical Commission at Bellagio and Rome, and he was also a delegate, along with Dr. Charles Camsell, M.E.I.C., to the World Power Conference at Carnobbio.

Mr. Murphy's address was in his own inimitable style, interspersed with numerous humorous anecdotes of the pleasantries and the embarassments which befell Canada's official delegate in an assembly speaking many tongues. K. M. Cameron, M.E.I.C., presided in the absence of Naulon Cauchon, M.E.I.C., chairman of the branch, and, at the conclusion, warmly thanked Mr. Murphy for a most interesting address. An abstract of this address appears on another page of this issue of the Journal.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary-Treasurer.
B. Ottewell, A.M.E.I.C., Branch News Editor.

Electrical Equipment of International Paper Company's Gatineau Mill

At the season's inaugural meeting, held October 27th, 1927, a series of three papers was given describing the electrical equipment of the modern paper mill and having particular reference to the Canadian International Paper Company's new mill at Gatineau, Quebec. The speakers were A. B. Gates, A.M.E.I.C., general engineer; B. Ottewell, A.M.E.I.C., d.c. engineer, and W. E. Ross, A.M.E.I.C., industrial control engineering department, all of the Canadian General Electric Company, Peterborough.

The chairman, A. E. Caddy, M.E.I.C., in his introductory remarks, pointed out that 80 per cent of the electrical equipment and a portion of the other machinery installed in this tremendous building were supplied by Peterborough concerns.

General Description of Electrical Features

In giving a general description of all the electrical features of this development, Mr. Gates mentioned that it was decided in 1925 to erect a 600-ton mill at Gatineau, five miles from Ottawa, on the Quebec side of the Ottawa river.

To ensure a plentiful and steady flow of water in the Gatineau an impounding dam was built at Bitobee, 125 miles above Ottawa on the Gatineau. This dam holds 95,000,000,000 feet of water, cost $10,000,000, forms a lake 110 square miles in area and increases the flow of the river from 2,500 to 10,000 cubic feet per second, allowing a final development of 750,000 h.p. on the whole river. Power for the Gatineau paper mill is transmitted from Chelsea, a distance of ten miles, at 115,000 volts over a double steel tower line.

The company owns 8,000 square miles of timber along the Gatineau valley.

Twelve 2,650-h.p. synchronous grinder motors each drive two five-foot stones. The logs are fed into a magazine from an upper floor and are held against the stones by a slow moving toothed chain, motor driven. The chain motor is so controlled that the load on the main driving motor may be maintained at any set figure, or if a stone is out of order half load may be maintained on the motor.

Coming now to a description of the paper machines themselves, the following dimensions prove the Gatineau machines to be the largest in the world:—

The rolls are 270 inches, or 22½ feet long.

The dryer section comprises forty-eight 5-foot diameter cylinders, and is 150 feet long.

The machine is designed for 1,200 f.p.m. paper speed at 250 volts, or 1,440 f.p.m. with 300 volts.

The motors on each machine are fed by a 750/900-k.w. d.c. generator driven by a steam turbine, and the exhaust steam is used in the dryer rolls.

A spare generator driven by a 1,375-k.v.a. synchronous motor is used as a standby for each pair of paper machines.

All the electrical apparatus is located back of the paper machine, but is controlled by push button stations on the front of the paper machine.

The four machines now installed and operating twenty-four hours a day, six days per week, at Gatineau require per hour:—

Eight acres of spruce, (equivalent to 146 acres of paper).

Eighty thousand tons of water.

Fifty-six thousand k.w. of electrical energy (city of Peterborough uses 3,600 k.w.).

Two hundred and eighty tons of steam, (electrically generated).

The paper produced per hour will make 1,080,000 16-page newspapers.

One New York daily uses 875 tons for its Sunday edition, or the output of the Gatineau mill for twenty-two hours.

The mill has its own pumping and filtration plant, and all water used for culinary or drinking purposes is treated with ultra-violet rays to kill possible disease germs. Storage battery trucks are used to handle broken boxes and trailers. The fully equipped machine shop is electrically driven. Electrically heated glue pots are used in the shipping department. Electric hot plates are used to heat hand irons for joining ends of paper rolls by means of mending tissue. The pressboard ends of the paper rolls are sealed into place by hydraulically-operated electric hot plates. Flood lights play from the mill roof on all working locations in the yard, making night operation as safe as day operation. An auto call system keeps all superintendents and foremen in touch with the telephone exchange. The employees' residences are equipped with electric ranges and water heaters.

Sectional Electrical Driving Units

The second paper, by Mr. Ottewell, described the section electrical driving units of the paper machine.

The four drives at Gatineau are of the "synchronous tie-in type," in which the exact speed ratio between sections is maintained by the use of small auxiliary synchronous motors, mechanically connected, through gears, cone pulleys and belts to the main d.c. driving motors.

All the d.c. motors are separately excited from a compound wound exciter whose voltage is held constant by a regulator. The motors are supplied with power from a generator, either steam turbine or synchronous motor driven, which is also separately excited. By controlling the excitation of the main generator its voltage is varied, and therefore the speed of all the motors is proportionately varied.

Slow speed direct-connected motors are used on all of the sections except the dryers, which are provided with totally enclosed moderate speed motors driving through a special design of bevel gears and inclined shafts on the paper machine.

Motors are designed to operate at 245 volts for a paper speed of 1,200 feet per minute, with a possible increase to 300 volts and 1,440 feet per minute. The generator voltage is held constant by a regulator at any desired value corresponding to the paper speed required.

The general arrangement of each of the sections comprises the d.c. driving motor, flexible coupling, herringbone gear speed reducer, cone pulley, belt, belt shifter and synchronous tie-in motor. The belt shifter is motor operated through a small d.c. motor and gear enabling the adjustment of "draw" to be made by remote control from the front of the paper machine.

In the special dryer drive there are four d.c. motors connected in series in the dryer line shaft and in addition there are five induction "kicker" motors to assist in starting and for operation when d.c. supply is shut down. The master alternator is also connected in the dryer line shaft.

Power for the operation of each paper machine drive consists of a 750/900-k.w. 250/300-volt generator driven by a geared steam turbine, the exhaust steam being used in the dryer drums. Spare motor generator sets are provided for emergency use when the dryers are shut down.

The speaker described the design characteristics of the d.c. units and also gave a few notes on some experiences in the starting up and operation of these drives.

Control Devices

The third paper of the evening, which was presented by Mr. Ross, dealt with the control devices used in conjunction with the sectional paper machine drive. Mr. Ross pointed out that this control equipment is such that the various operations can be carried out by the machine tenders with a minimum of effort, due to the location of push buttons at convenient points, and that it is such that the sequence of operation is fixed and will always be performed in the same relative time.

By the aid of two large photographs showing the front and back view of the complete panel for the sectional drive, the speaker described in detail the object of each device and its method of operation in controlling the section units.

The papers were much appreciated by the members present and a considerable amount of interesting discussion subsequently took place.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

The first meeting for the fall and winter seasons, 1927-1928, of the Saint John Branch was held on October 28th, 1927, in the New Brunswick Telephone Company building. S. R. Weston, M.E.I.C., the branch chairman, presided at the meeting, at which there were eighteen persons present.

Geoffrey Stead, M.E.I.C., the representative of this branch on the Council, had recently attended the Plenary Meeting of Council in Montreal and read a lengthy report of the various sessions with the business considered. Mr. Stead later enlarged on his written report by giving further verbal details of various matters discussed. Keen interest was shown in the account of the various items taken up at the Plenary Meeting, and the report of Mr. Stead was adopted on motion of G. G. Murdoch, M.E.I.C., and F. P. Vaughan, M.E.I.C.

Sanitary Drainage

A paper on sanitary drainage was read by G. G. Murdoch, M.E.I.C. In this, an historical account was given of the various known types of sewers in different countries from the time of the Romans down to the present time. A résumé of the various statutes and ordinances,—often contradictory and later found inoperative and having to be repealed,—dealing with sewers and the uses to which these were intended to be subjected proved very interesting, and the story showed a growing appreciation throughout the years of the need of proper sanitation by adequate sewerage systems.

The technical details of the various construction materials used in sewers were described, also the objects in using different types of cross-sections for various locations and purposes was discussed. For houses and public institutions not connected with a modern sewerage system, the method of sewage disposal by septic tanks was treated in detail, and this subject caused many enquiries in the discussion on this paper.

J. N. Flood, A.M.E.I.C., chairman of the programme and meetings committee, reported on behalf of this committee a programme of meetings for the coming season had been completed and the printed copies would soon be received and sent to the members.

Second Empire Mining and Metallurgical Congress

A short talk on the Second, (Triennial), Empire Mining and Metallurgical Congress was given by W. J. Johnston, A.M.E.I.C. The objects and various details in the formation of the Mining Congress movement were described, also an account of the tour made in Canada and Newfoundland during the past summer.

Votes of thanks to the speakers were moved by Geoffrey Stead, M.E.I.C., and J. N. Flood, A.M.E.I.C.

Passamaquoddy Bay Power Development

A meeting of the branch was held on the evening of November 17th, 1927, in the New Brunswick Telephone Company building, at which S. R. Weston, M.E.I.C., presided and welcomed the large number of the general public present at the meeting, the total attendance being about ninety. Mr. Dexter P. Cooper, the speaker of the evening, was introduced by the chairman. The subject of the address was "The Passamaquoddy Bay Development." This is a subject of unusual interest throughout the Maritime provinces at the present time, as two tidal schemes, situated several hundred miles apart, are at present being actively advocated as a possible means of generating large blocks of electrical energy.

Passamaquoddy bay is at the mouth of the St. Croix river, forming the southern boundary between News Brunswick and the state of Maine. It is proposed to dam the mouth of Passamaquoddy bay, so that the project is of international interest. This development proposes to use the rise and fall of the tides of the bay of Fundy for generating electricity. Owing to the favourable topographical formation in this region, it is possible to construct works at a reasonable cost which will allow the creation of two large reservoirs or pools. The upper pool will serve as a reservoir of supply to the power house, while the lower pool is a reservoir to receive the water from the power house. At no time are the levels of these two pools to be the same, thus assuring a continuous output of power. At high tide the upper pool is refilled and at low tide the lower pool is drained.

It is proposed to build dams between the shores of Passamaquoddy bay, (about nine miles wide in a direct line at this place), and several islands in this vicinity, thereby creating the two pools. The islands comprise 85 per cent and proposed dams 15 per cent of the total distance to be closed.

The maximum tide observed at this place has been over 26 feet, but this height is exceptional. Varying with spring and neat tides, it is expected the plant will have working heads of from 8 to 24 feet. The turbines are to be designed for the minmum head of 8 feet. It is not intended to build a covering for the power house, which would extend possibly 3,000 feet along the dams and be an expensive structure, but rather to have a travelling crane which would place a temporary structure over any unit, as required.

The initial development will depend on market prospects, but it is estimated at least 400,000 h.p. may be developed at the site.

After Mr. Cooper's address, the meeting was thrown open for discussion, during which Mr. Cooper was asked many questions. A vote of thanks to Mr. Cooper was moved by Geoffrey Stead, M.E.I.C., and J. N. Flood, A.M.E.I.C.

St. Maurice Valley Branch

Romeo Morrissette, A.M.E.I.C., Secretary-Treasurer.

The first general meeting of the St. Maurice Valley Branch of The Institute was held at Shawinigan Falls, Que., on October 22nd under the chairmanship of Ellwood Wilson, M.E.I.C., chairman of the branch. The guests of honour were Julian C. Smith, M.E.I.C., vice-president of the Shawinigan Water and Power Company, and A. R. Decary, D.A.Sc., M.E.I.C., president of The Institute. There were present about sixty members and friends, and after visiting the power plants dinner was served at the Cascades Inn.

Following the dinner the members were addressed by Julian C. Smith, M.E.I.C., A. R. Decary, D.A.Sc., M.E.I.C., Henri Dessaulles, A.M.E.I.C., H. O. Keay, M.E.I.C., F. W. Skirrow, E. R. Williams, Romeo Morrissette, A.M.E.I.C., C. H. Jetté, A.M.E.I.C., and J. A. Bernier, A.M.E.I.C.

The meeting was reported in French, as follows:—

La premiere assemblee de la section de la Vallee du St.-Maurice

La première assemblée de la section de la Vallée du St-Maurice de l'Engineering Institute of Canada a été tenue samedi après-midi, le 22 octobre dernier à l'école anglaise de la cité de Shawinigan Falls. Elle était sous la présidence de M. Ellwood Wilson, M.E.I.C., président de la section. Il y avait comme hôtes d'honneur, M. Julian C. Smith, M.E.I.C., vice-président de la Shawinigan Water and Power Co. Ltd., et M. A.-R. Decary, Dr. ès S. A., M.E.I.C., président général de l'Engineering Institute of Canada.

Il y eut visite des usines du pouvoir et de la Canadian Carbide Co. Ltd.

Après la visite des usines, il y eut un diner au Cascades Inn.

A l'école anglaise, M. Ellwood Wilson ouvrit la série des discours. Il se sent heureux de constater les progrès qu'a fait la section en 1927. Il y a eu des réunions tous les mois l'an dernier. L'on s'y est rendu. L'assemblée nombreuse d'aujourd'hui est la plus belle récompense que l'on puisse donner aux directeurs comme marque d'appréciations de leurs efforts. C'est l'intention que l'année qui commence soit encore plus active et plus intéressante. On veut qu'il y ait de l'ampleur dans l'étude des sujets qui seront présentés pour discussion. Il n'y a aucun doute qu'ils seront toujours d'intérêts pour les ingénieurs et les membres de cette section. L'on doit s'associer pour étudier les différents problèmes du génie civil sous leurs différentés formes, afin d'obtenir les solutions qui permettront à notre profession d'être un plus grand facteur dans notre développement industriel et économique.

Cette année la section devra se choisir un nouveau président. Il espère que le choix se fera judicieusement, que le nouveau président continuera l'œuvre déjà si bien commencée et que ce sera pour la plus grand succès des ingénieurs de la vallée du St-Maurice. Il introduit ensuite M. Julian Smith comme un des pionniers du développement industriel de la région de la vallée du St-Maurice et principalement de la ville de Shawinigan Falls.

M. Smith est l'orateur suivant:—

Pendant ces dernières vingt-cinq années il a été heureux d'aider au développement de la région du St-Maurice et principalement de la vallée du St-Maurice. Il n'aurait pu rien faire seul, si ce n'eut été l'aide et de l'appui que lui ont donnés les ingénieurs qui ont été ses associés. De tout temps, les savants ont été des ingénieurs. D'abord, dans l'organisation et la mise en oeuvre des campagnes militaires. Puis graduellement, ils ont appliqué leurs connaissances et leurs sciences dans d'autres champs d'action. Depuis environ cent ans, le génie civil s'est développé et il est devenu une grande profession. Les découvertes de l'électricité, la vapeur, l'amélioration des moyens de transport et leur disponibilité à la portée de tous ont contribué à développer la civilisation industrielle et à la faire ce qu'elle est aujourd'hui. Il y a un siècle environ, ce fut d'abord la vapeur. En 1870 l'électricité faisait réaliser que c'était une invention qui devait jouer un grand rôle dans l'industrie. En 1882 Edison apportait l'une des plus grandes contributions à l'usage de l'électricité. En 1895 vinrent le harnachement des pouvoirs d'eau, ce qui donna lieu à l'étude et au développement et l'érection des grandes lignes de transmission de l'électricité, ainsi qu'à la mise en place des usines de distribution. Le génie fit réaliser un développement considérable dans l'industrie.

Voilà pourquoi il a déclaré que l'ingénieur avait été l'un des plus grandes facteurs à la civilisation du monde industriel. Sa science est basée sur des faits, les faits sur la vérité. Il a fait commerce avec les forces de la nature. C'est la fin de cette profession. Regardant ce qui s'est produit dans le dernier quart de siècle, il a à se demander ce que les prochaines cinquante ans nous réservent. Personne ne le sait et ne s'en doute. C'est pourquoi le travail de l'ingénieur apporte chaque jour une contribution tourjours de plus en plus grande pour le bien-être de la communauté, qui est dominée par l'étude intelligente des questions et des problèmes généraux par un corps d'élite tout dévoué.

Il n'y a pas seulement dans l'industrie que cette efficacité a produit ses fruits, mais même dans l'administration de la chose publique. L'ingénieur est devenu un administrateur et quel succès a déjà obtenu l'administration de nos villes par ces gérants. L'attention de nos ingénieurs devrait aller plus loin et s'étendre sérieusement à la formation et au remaniement de notre mode éducationnel dans l'industrie. Les manières et les modes changent tous les jours tant chez les hommes que chez les femmes, il en est ainsi de la mentalité, de l'éducation et de l'entrainement de la communauté. C'est pourquoi il faut être préparé à donner un enseignement en rapport avec les exigences nouvelles. Il faut lui enseigner à mieux maîtriser et à plus profiter des forces de la nature. C'est là la fin de notre profession. Ce que les découvertes ont mis en relief devrait être appliqué par les membres de notre profession, ce serait le plus grand concours que nous pourrions apporter dans l'administration et le développement des affaires et qui ferait surgir un monde nouveau et plus grand.

Il invite les membres à visiter les usines de la compagnie Shawinigan Water and Power Co. Ltd.

M. Wilson en remereiant M. Smith dit que l'orateur a touché une note qui est à son heure et qu'elle pourrait être le sujet d'étude plus approfondie de la part de la section. Puisqu'il a été question du rôle de l'ingénieur dans l'avenir, il se demande si le temps n'est pas venu que l'ingénieur ne se considère plus comme un administrateur mais qu'il envisage de plus larges horizons et qu'il vienne à occuper des postes dans la vie politique de son pays. A l'heure qu'il est le nom le plus en vedette pour le poste de président des Etats-Unis est celui d'un ingénieur. Si nous sommes de bons administrateurs pourquoi n'aurions nous pas la confiance pleine et entière de notre pays. Ottawa et Québec devraient avoir dans un avenir rapproché dans ses cabinets des ingénieurs. Ce serait un point qui mériterait étude et suggestions. Le président se dit heureux d'avoir M. Decary à ses côtes et il l'invita à adresser la parole.

M. Décary se dit très flatté d'accepter l'invitation du président de la section de la vallée du St-Maurice, pour deux raisons:

1—Pour constater quels progrès merveilleux la section a réalisés en 1927; c'est plus que certains membres sceptiques qu'il voit devant lui espéraient. 2—Parce qu'il a eu le plaisir de siéger avec M. J. C. Smith au conseil général de l'institut depuis pleusieurs années et qu'il connait de quel commerce agréable il est.

La première fois que l'on se rencontre aux Trois-Rivières il y avait si peu de membres qu'il pensa qu'il n'y aurait jamais de section de la vallée du St-Maurice. Il est certain qu'elle est maintenant solidement assise. Il sait que le président, M. Wilson, a été très dévoué à cette œuvre, que le succès lui en revient et il est sûr qu'il fera plus pour l'avenir. Il souhaite de voir la section toujours grandir et devenir de plus en plus prospère.

M. Dessaulles prend ensuite la parole: Puisqu'on l'a désigné comme prochain orateur, c'est probablement, dit-il, parce que sa famille détient le record canadien de ce qui peut se faire par un homme dans la vie publique, que probablement cela pourrait lui être imposé comme un encouragement. Il a déjà été et il est échevin de sa ville et commissaire d'école. Un homme n'est un homme que s'il fait quelque chose de grand: sans doute, ajoute-t-il que l'on s'efforce de lui trouver de la vocation.

MM. Keay, Skirrow, Williams, Morrissette, Jetté, Bernier, adressèrent aussi la parole.

Saskatchewan Branch

M. B. Weeks, M.E.I.C., Secretary-Treasurer.

A regular meeting of the Saskatchewan Branch was held in the Saskatchewan hotel, Regina, on November 18th, which was attended by some thirty-two members and guests. The guests included J. F. Warren and T. E. H. Quail of the Montreal Engineering Company; C. D. Lill, newly appointed representative of the Manitoba Bridge and Iron Works in Regina; Capt. W. H. Blake, D.E.O., M.D., No. 12; Geo. F. Porter, of the Eugene Phillips Company; W. T. Hunt, manager of the Northern Electric Company, Regina branch, and P. McAra, ex-mayor of Regina and one of the earliest settlers of this district.

After the toast to "The King" had been proposed by the chairman, M. B. Weekes, M.E.I.C., the minutes of the last regular meeting were read and reports of standing committees received.

Ten-minute addresses were given by a number of the members of the branch covering the activities of their respective departments during the past year, which may be briefly summarized as follows:—

S. T. Lewis, Division Engineer, Canadian Pacific Railway Company

Mr. Lewis outlined the work of the Canadian Pacific Railway Company in the Regina division. Business for 1927 had been exceedingly good, necessitating many improvements in the way of new stations, enlarged freight sheds, private spurs, track maintenance, ballasting, etc. Experiments were carried out during the past two years with the Atlas weed killing chemicals, both of poisonous and non-poisonous varieties. The results appear to be very successful if the chemical is applied at the proper season. The company's business in this district is increasing rapidly and prospects are bright for the future.

R. H. Murray, A.M.E.I.C., Sanitary Engineer, Provincial Department of Public Health

Mr. Murray referred to the work of the Provincial Department of Public Health in conserving the lives of our citizens. He gave as an example the abandonment of the water supply for the town of Humboldt taken from a lake to the south of the town in favour of a supply from a point north of the town, owing to the sewage from the town finding its way to the former at certain seasons of the year. The town of Shaunavon is unique in that it has a sewer system and sewage disposal works but has not any water supply system, the reason for this being the ease with which supplies of good water are obtained from underground wells. For this reason a sewage disposal works was imperative and the construction of it has no doubt saved many lives. He referred to the protection of public milk supplies and the fatal epidemic which occurred in a college in Regina recently owing to the use of non-pasteurized milk. Of the public milk supplies for urban centres in Saskatchewan 80 per cent are pasteurized.

J. W. D. Farrell, A.M.E.I.C., Superintendent Waterworks, Regina City

Mr. Farrell referred to the work of his department and also some of the other departments of the city of Regina. Building permits for 1927 were approximately $3,500,000. There have been installed 681 new light and power services, making a total of 11,200 services now in use. The output of the municipally owned and operated plant for the year is over 23,000,000 k.w., an increase of 20 per cent over 1926.

During 1927, 12,000 feet of new street pavement has been laid; 25,460 feet of concrete sidewalks constructed; 9,000 feet of storm sewers, and 8,000 feet of domestic sewers.

There were 6,200 feet of new watermains laid in 1927, making a total to date of 68.4 miles; there were made during the year 444 water connections and 400 active sewer connections. The average water consumption for the year has been 2,900,000 gallons per day.

A portion of the old wooden water mains in the city, which were laid in 1905 and 1906, have been replaced with steel pipes with practically no interruption to the services. These old wooden mains are on the whole in good condition, but failure has taken place in the wire bands and at the juncture of house connections.

Mr. Farrell told of the search for additional water supplies for the city at Mallory springs and Silver creek, a district about four miles east of the city. The surface springs in this vicinity induced the city to sink several test wells. Water was found in each test well, but several were not satisfactory producers. Two of these wells give promise of a satisfactory flow, and the whole district may prove to be a valuable addition to Regina's water supply.

From statistics covering a large number of Canadian cities, Regina is second to Victoria, B.C., in permanent hard surface pavement in proportion to population, slightly exceeding Toronto, Winnipeg and Calgary.

H. B. Sherman, A.M.E.I.C., of the Provincial Department of Telephones

Mr. Sherman summarized the new construction, alterations, etc., throughout the province in 1927, involving an expenditure of approximately $2,000,000.

Report of H. R. Mackenzie, A.M.E.I.C., on the First Plenary Meeting of Council in Montreal, October 10th-12th

Mr. Mackenzie attended the Plenary Meeting of Council recently held in Montreal, at which twenty-nine members of Council from all parts of the Dominion were present. A full report of this meeting is given in the November issue of the Journal and will not be covered in this report. Mr. Mackenzie's verbal report, however, was much appreciated and was followed by a general discussion of the points dealt with by him.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting was held on Friday evening, October 28th, 1927, in the Y.M.C.A. building, with Geo. Kohl, M.E.I.C., as chairman.

J. O. Twinberrow, A.M.E.I.C., chief engineer of the boiler department of the Babcock-Wilcox and Goldie-McCulloch, Limited, of Galt, Ont., was the speaker. He gave a splendid address on the construction and operation of modern high pressure boilers. He said "that the progress in the power plant industry has of late years been so rapid that only those who are intimately connected with the industry can obtain a true perspective of the trend of events and design, and it may be truly stated that what we consider the best solution for any particular problem to-day may be entirely out of date twelve months hence."

The comparison of the different boiler installations in various countries was worthy of note, and, on account of the variety of the installations used throughout the country, he said that boilers are usually made by contract to specifications and are not kept in stock by the manufacturers.

In referring to the term "high pressure," he said it was rather indefinite, as a few years ago 250 lbs. was looked upon as a high pressure, while to-day boilers designed for 1,200 lbs. or more are being installed and are giving good service.

"The practical idea to be approached is an efficient prime mover operated at a sufficiently high pressure to generate the required power most of the time at least with less steam than is required for the process, and the day is not far off when many industrial plants will be operated on steam pressures of 500 to 600 lbs. and in some plants where a comparatively high back pressure and relatively large power demand may justify pressures of 1,000 lbs. or more."

The design, the construction, the installation and the operation of a modern plant were most vividly portrayed by the aid of slides and the following four reels of pictures:—

(1) The operation of typical boilers.
(2) Construction of drums for high pressure installations.
(3) Superheater construction, including tubes and leaders.
(4) Section building and testing of tubes.

Mr. Kohl welcomed the guests present, and hoped that the interest shown would be kept up at our future meetings. He also expressed his appreciation to the speaker on his splendid paper.

A general discussion followed, and then Col. C. H. L. Jones, M.E.I.C., complimented Mr. Twinberrow on his lecture and moved a hearty vote of thanks that was seconded by all present.

A special meeting was held at the Y.W.C.A. on November 15th to discuss the engineering features of the proposed hydro-electric development of St. Mary's rapids at the Sault.

G. H. Kohl, M.E.I.C., chairman, called the meeting to order and outlined the object of calling this special meeting. He welcomed the guests, among whom were aldermen and city officials. He said that as citizens and also as engineers we should take special interest in this proposed development and he felt that a thorough investigation of the engineering features, entering into such a development, should be carried out, and if the Sault engineers could help the Hydro-Electric Power Commission in this matter that it was their duty to do so, as they had a working knowledge of the water conditions here.

W. S. Wilson, A.M.E.I.C., read a paper by C. H. Speer, M.E.I.C., which gave clearly the water rights as outlined in the International Joint Waterways Commission, "Order of Approval," etc. H. A. Morey, A.M.E.I.C., assisted Mr. Wilson in explaining the charts which showed the water conditions, (elevations, head and flow), since 1860. It was clearly shown that during the period from October 1920 to August 1926, (fifty-eight months), the water was below the average as determined by the Hydro-Electric Power Commission, and that during this interval there was a period of a whole year when the average was only 40,470 c.f.s.

A general discussion followed and many interesting engineering points that had a direct bearing on the construction costs of a plant situated in St. Mary's rapids were brought out. In this way it was felt that the estimated cost of power was almost an unknown quantity at this stage of the game and would be so until all conditions had been thoroughly investigated by the Hydro-Electric Commission.

On motion of C. H. E. Rounthwaite, A.M.E.I.C., and G. W. Holder, Jr.E.I.C., the following resolution was passed:—

Whereas, a proposition has been presented to the city council looking to further development of power in the St. Mary's river,

And whereas, the proposition has not been accompanied by any engineering details as to construction nor costs thereof,

And whereas, no general or detailed plans have been presented showing location of the works, including intake and tailrace,

And whereas, there is a feeling among this body of engineers that, without these details, an intelligent decision cannot be reached,

Therefore, be it resolved, at this meeting of members of the local branch of The Engineering Institute of Canada, that the mayor and city council be urged to obtain the necessary information, relative to the project, before submitting the question to the ratepayers for decision.

Be it further resolved, that a memorandum be prepared, outlining some of the essential points requiring consideration, and that a copy of this memorandum and resolution be forwarded to the mayor and council, chairman of the Public Utilities Commission, and chairman of the Board of Trade.

Memorandum

(1). Quantity of water available for power which, from government information in hand, indicates a much smaller flow than an average 5,000 second-feet continuously available.

(2). The gross head available which, from government records, indicates that there have been times when the monthly average gross head was as low as seventeen and one-half feet.

(3). The conditions as to foundations which, in the following instances, developed serious engineering difficulties.

(1). The piers under the International bridge.

(2). The washout under generator No. 14 and the spillway of the Great Lakes Power Company, when mud seams of considerable thickness were encountered forty feet below the established minimum level of lake Superior.

(3). The washout under the Ground Wood Mill of the Spanish River Pulp and Paper Mills.

(4). The character of load which may be served by the proposed plant, as it has a direct bearing upon the actual cost of power and the quantity of water required to satisfy the load.

Toronto Branch

W. B. Dunbar, A.M.E.I.C., Secretary-Treasurer.
J. W. Falkner, A.M.E.I.C., Branch News Editor.

The executive of the Toronto Branch, after a "get together" during the summer with the executives of the Toronto branches of other engineering societies, made arrangements to hold the regular meetings during the coming season, 1927-1928, on the *first* and *third* Thursdays of the month, this being a measure of co-operation to avoid more than one engineering meeting in any one week, except under exceptional circumstances. The regular meetings of other local engineering societies will usually be held for the coming season in the second, fourth and fifth weeks of the month, and it is planned to have the various societies reciprocate in the announcement from week to week of each others' meetings.

University of Toronto Centenary

Owing to the Centenary celebrations of the University of Toronto, in which a great many of the Toronto Branch members participated, it was decided not to hold a meeting on the night of October 6th, but to postpone the usual opening night until October 20. Members of our branch were, of course, well represented at the University of Toronto Centenary celebrations.

Ice Engineering

(*Meeting reported by J. J. Traill, M.E.I.C.*)

The opening meeting on October 20th was exceptionally well attended, about three hundred and twenty-five members and visitors being present, completely filling the lecture room.

The speaker was Howard T. Barnes, D.Sc., M.E.I.C., F.R.S., professor of physics at McGill University, who addressed the meeting on "Ice Engineering." Dr. Barnes dealt first with the physics of ice formation. Chemical investigations have shown, many years ago, that ice is present in water at all temperatures in the form of trihydrol or $(H_2O)_3$, 17 per cent of the water consisting of this molecular form at the boiling point and 37 per cent at the freezing point. A process of agglomeration of these proceeds readily under suitable conditions, as, for example, when water is cooled and disturbed frazil is formed. The speaker explained also, with the aid of lantern slides, the formation of ice in other forms and the constitution of ice jams in rivers, and dealt with the factors contributing to and preventing ice formation.

Heat is the natural tool to use for prevention of ice formation, and the problem in ice control is its effective and economical application. The use of explosives, he had concluded, was not attended with results commensurate with the danger involved. The essential thing was the application of heat in such a way as to break down the film of cohesion between the ice crystals, an extremely small temperature rise, perhaps the thousandth part of a degree, sufficing to effect this. Applying sufficient heat to melt the ice is, however, not feasible. The proper method to use is the distribution of radiant heat through the ice mass.

The speaker described in considerable detail, and with the aid of slides and moving pictures, the application of radiant heat to a number of ice jams by burning thermit at carefully selected points. Particularly interesting among the illustrations were slow motion pictures of the burning of thermit in blocks of ice, in which the intense heat action and relatively mild explosion were well shown.

Chemical application to cause lines of weakness in surface ice, and thus permit ready destruction of surface ice at freshet time, were referred to.

Messrs. William Gore, M.E.I.C., and A. U. Sanderson, A.M.E.I.C., in discussion dealt with frazil ice difficulties at waterworks intakes, and described methods by which these difficulties were overcome. After further questions, the hour being late, the meeting was closed with a hearty vote of thanks to the speaker.

A well attended dinner was tendered to Dr. Barnes at the Engineers' Club preceding the above meeting.

Joint Meeting at St. Catharines

(*Reported by J. J. Traill, M.E.I.C.*)

A special meeting of the branch was held at St. Catharines on Friday, October 28th, in association with local branches of the A.I.E.E. and A.S.M.E., the Hamilton, and Niagara Peninsula branches of The Engineering Institute of Canada and the Buffalo Engineering Society. About thirty members of the Toronto Branch were present, while the whole Toronto attendance numbered close to one hundred.

The day was spent in an inspection of the Welland Ship Canal from Port Colborne to Port Weller, the Toronto Branch members joining in the inspection at lock No. 7 at Thorold, transportation along the canal being kindly provided by the canal authorities. After dinner at "The Welland," at which the Toronto Branch members were entertained by the Niagara Peninsula Branch, the company proceeded to the St. Catharines Collegiate Institute, where, before an audience of five hundred, papers were read by Alex. J. Grant, M.E.I.C., on "The Welland Ship Canal"; Mr. Fred. D. Corey, on "Possibilities of More Power from Niagara Falls"; Dr. H. G. Acres, M.E.I.C., on "The Power Possibilities of the St. Lawrence River"; and Mr. Edward P. Lupfer, on "The Buffalo-Fort Erie Peace Bridge."

Non-Bituminous Highway Materials

(Reported by C. B. Ferris, A.M.E.I.C.)

At the regular meeting of the Toronto Branch, held on November 3rd, Mr. A. T. Goldbeck, director of the National Crushed Stone Association, Bureau of Engineering, and formerly chief, Division of Test, Bureau of Public Roads, Washington, D.C., gave a very able and interesting paper on "Non-Bituminous Highway Materials and Their Uses."

Preceding the meeting, an informal dinner was held at the Engineers' Club to welcome Mr. Goldbeck.

The meeting was well attended, many prominent highway and municipal engineers being present at the meeting, including several from Hamilton and Brantford. It was also a pleasure to welcome many out-of-town visitors from the Provincial Highways Department.

In the course of his address, after referring to the different classifications of the 3,000,000 miles of roads in the United States, Mr. Goldbeck discussed the economic justification for the use of various types of road materials, and the factors to be considered in their selection, according to the kind of road and surface required.

The different types of roads, including earth, "traffic bound," gravel and water-bound macadam, "re-tread," bituminous macadam, bituminous concrete, "amiesite" and concrete pavements were described in detail, with views of work under construction.

In addition to conditions of soil, traffic data, tests, etc., the methods of combining available materials to suit the requirements were all dealt with, including the different forms of penetration.

Following the address, an interesting discussion was contributed by Prof. Lang; W. A. McLean, M.E.I.C.; R. M. Smith, A.M.E.I.C., deputy minister, Department of Public Highways; F. B. Goedike, A.M.E.I.C., engineer of York township; M. A. Stewart, A.M.E.I.C., of the Toronto Roadways Department, and R. O. Wynne-Roberts, M.E.I.C., who moved a hearty vote of thanks to the speaker.

Vancouver Branch

F. P. V. Cowley, A.M.E.I.C., Secretary-Treasurer.

During the summer season of 1927, three regular meetings of the Executive Committee were held, July 6th, September 14th and October 19th. In addition to these, a special committee meeting was held on August 8th to welcome R. J. Durley, M.E.I.C., general secretary of The Institute, on the occasion of his visit to the western branches.

Matters of interest to The Institute and to the branch were discussed with Mr. Durley, the outstanding subjects being:—

(1) The Western Professional Meeting to be held in Vancouver in the early part of June 1928.
(2) The meeting of Council to be held in Montreal in the second week in October 1927.
(3) The newly formed Student Section of the Vancouver Branch.

On August 11th, F. W. Alexander, chairman of the branch, was transferred to Winnipeg, and tendered his resignation as chairman. Mr. Alexander has been a leader in all activities of the branch and will be greatly missed. The members of the branch, however, congratulate him on his advancement in the service of his company and are glad that he will still continue to be an active member of The Institute.

The Student Section of the branch is taking an active interest in Institute affairs. Already two very successful meetings have been held by the Section this fall.

Kenya Colony and the Kenya and Uganda Railway

The first meeting of the branch this fall was held on Wednesday, November 9th, at the University Club, and started off the winter's activities with the excellent attendance of ninety-five. The branch was fortunate in securing as speaker Brig.-Gen. G. D. Rhodes, C.B.E., D.S.O., M.E.I.C., deputy general manager and chief engineer of the Kenya and Uganda Railway, who was paying a short visit to Vancouver on furlough. Members of the Vancouver Branch of the Royal Military College Club, of which Gen. Rhodes is a member, were guests of the branch.

The subject chosen was Kenya Colony and the Kenya and Uganda Railway. Some seventy excellent slides graphically portrayed the difficulties of railroad building in East Africa, and how these difficulties are being overcome.

Commencing with a small scale map of the whole of Africa, the speaker outlined the history of East Africa in general and of Kenya and Uganda in particular. From the 8th to the 14th centuries, owing to frequent wars in Arabia and to expansion for commerce, the east coast was frequently visited by Arabs, and Mombasa became a town of importance, eventually what is known as the Zanzibar Empire being formed.

In 1498, Vasco de Gama arrived at Mombasa, and, following his visit, the city was occupied by the Portuguese and held by them for one hundred and fifty years. In 1698, Arabs from the state of Oman again captured Mombasa and Zanzibar, and Zanzibar became the head of the Arab rule up and down the coast.

About 1824, certain coast towns wished to break away from Zanzibar rule and sought the protection of the British, but their requests did not meet with favour in England. Rather, the Arab rule was further consolidated on the coast and even extended into the interior. The slave trade grew and flourished until finally Great Britain stepped in to suppress it, working in agreement with the Arab ruler. The trade was gradually reduced until it was definitely prohibited by a treaty made in the year 1845.

During this collaboration on the slave trade, the Arab rulers grew to appreciate British protection, and in 1878 offered them a concession in their east coast possessions. This, however, was not favourably considered in London. German activities, on the other hand, were supported by their home government and many concessions were obtained by them.

In 1885, a joint commission of Great Britain, Germany and France defined the limits of the Zanzibar government to a ten-mile strip of coast. The year 1888 saw the formation of the Imperial British East Africa Company by Sir William MacKinnon. About the same time, a German company was also formed for similar enterprises, which company was frequently involved in trouble with the natives, which led to international disputes. Finally, in 1890, an international agreement defined the "spheres of influence" of Great Britain and Germany, the Imperial British East Africa Company renting the coast strip.

Meanwhile, much exploratory work had been going forward. In 1844, the Germans, Knaph and Rebman, started their travels resulting in the discovery of the mountains Kilimanjaro in 1848 and Kenya in 1849. The British explorers, Burton and Speke, reached lake Victoria Nyanza in 1860, experiencing much trouble with the Masai natives, and in 1833 Mr. Thompson, (British), penetrated to Baringo, lake Victoria and Mt. Elgon.

In 1895, the Imperial British East Africa Company relinquished its charter to the Crown, thus giving birth to the British East African Protectorate under the Foreign Office, and 1896 saw the commencement of the Uganda Railway to go from the coast to Uganda, a most difficult piece of construction work, with trying times for the construction engineers owing to lions, water troubles and very unskilled labour, most of the latter being brought over from India.

In 1905, control of the Protectorate was transferred from the Foreign Office to the Colonial Office. Finally, in 1920, the highland area became a colony, the coastal region remaining a protectorate, the official designation now being "Kenya Colony and Protectorate."

Uganda had been closely involved in the earlier discoveries. Its natives were more civilized than those of Kenya, and missionary effort had made greater progress.

In 1893, the Uganda Protectorate was established and its boundaries defined, the future prosperity of Uganda being recognized even before that of Kenya.

The speaker, with the aid of slides, then gave a general description of the country, showing various views of Mombasa and the coast, and then following up the railway to the Highlands, with an altitude of 6,000 to 9,000 feet. The climate of Nairobi he described as almost ideal, cool evenings and warm and dry, but not hot, days. The variation in temperature during the year was very slight, almost so slight as to be monotonous.

The native products consist chiefly of maize, millet, beans, bananas, sheep and goats. The European settlers are doing well with maize, coffee, sisal, flax, fruits, stock raising, sheep raising, dairying, wheat and some mining. The climate is healthy in the Highlands for adults, but for children it is usually found desirable to send them to England from about the age of 10 onwards. The social life in the larger centres is now happily in full swing, thanks to the increasing European population.

Some facts and statistics in connection with the railway proved very interesting. The gauge is one metre, which is 2⅝ inches less than the more common standard, (3 feet 6 inches), of other African railways. The railway had not been considered as a source of revenue to the Colony and had been allowed to get into disrepair. Since 1923, however, its revenues had been used for betterment and extension of the line, and great improvement had been noted. The total mileage is now over 1,200, and connected with the railway are lake steamship routes and motor routes. The gross revenue during the last financial year was over £2,000,000. Surveys and new construction work are continuously being carried out with an eye to the future, when the system will form part of an extensive East African system. The growth of the Colony during the last twenty-five years was summarized from very small beginnings to the present state of importance. Last year's imports and exports amounted to the very considerable totals of over £10,000,000 each. The European population is now from 10,000 to 15,000; the Asiatic population, 30,000 to 40,000; and the native population 2 to 3 million. The government policy is the training of the natives and the encouragement of exports. The federation of the various East African dependencies was now being considered by the British government.

This most interesting and instructive paper was brought to a close with a series of beautiful views of Mt. Kenya, (alt. 17,040), from the tropical jungle growth at its base to its skating ponds, glaciers and snowstorms near its summit.

An interesting booklet entitled "Why You Should Insulate Your Home," has been issued by the Natural Resources Intelligence Service of the Department of the Interior, Ottawa. The booklet is illustrated and contains fifteen pages.

Dominion Insulator and Manufacturing Company, Niagara Falls, Ont., has issued a new booklet entitled "Lead Tip Steel Pins for Insulators," consisting of sixteen pages in colours. It treats of the importance of the pin to the insulator, placing particular emphasis on the necessity for proper pin selection to provide the most efficient insulator service. The booklet also describes and lists O-B double arm construction materials and double pin pole top brackets. Copies may be obtained upon request.

Hydro-Electric Power in New Brunswick

The New Brunswick Electric Power Commission has in operation 201 miles of distributing lines, in addition to the main transmission line between Musquash, where their principal hydro development is located, and Moncton, according to a statement made by Hon. E. A. Reilly, chairman of the commission, summing up the operations of the commission during the fiscal year which closed on October 31st.

There was generated during the year at Musquash 25,799,600 kw.hrs., of which 2,957,100 kw.hrs. were disposed of as surplus seasonal power, and the commission's customers demanded the remainder, or 22,842,500 kw.hrs.

The total mileage of new line erected or under construction during the year is sixty-three miles, some of the new districts reached by extensions during the year, including Nauwigewauk, Penobsquis, Dickson's Neck, Brule, Point du Chene, Barachois, Newton Heights and Colpitts.

The principal customers of the Provincial Hydro Commission are the cities of Saint John and Moncton, and the returns for the year show that service was carried on for these two principal urban centres with scarcely any interruption. During the year the service of the city of Saint John was interrupted accidentally on account of the commission's equipment and plant for a total of four minutes only, and the city of Moncton was cut off only twenty-six and one-half minutes during the entire year.

The Mines Branch, Department of Mines, Ottawa, has published a small booklet containing instructions for the burning of coal, coke and peat, based on a series of tests carried out at the fuel testing station at Ottawa. The booklet outlines the basic principles which should be followed in firing each of these fuels, not only in standard hot water furnaces but also in hot air furnaces.

An Interesting Aerial View of the Quebec Bridge.

Preliminary Notice

of Applications for Admission and for Transfer

November 15th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in December 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ANGELIS—MARIUS LEWIS DE, of Montreal, Born at Rome, Italy, June 26th, 1890; Educ., B.Sc. and A.C.G.I., London City & Guilds Engrg. College, 1910; 1910-11, test. dept. & drawing office, Brit. Thomson Houston, Rugby, Eng.; 1911-14, design and erection tramways substation, French Thomson Houston Co., Paris, France; 1914-17, service in French army; 1917-19, design and erection, steam and hydro-electric power stations, Nat. Def. work; 1919-26, principal engr., rly. & traction engrg. dept., Thomson Houston Co., Paris; at present, asst. electrical engr., Mtl. Tramways Co.

References: K. B. Thornton, C. V. Christie, G. A. Wallace, P. Seurot, E. G. Burr.

BARRETTE—ADRIEN, of Montreal, Que., Born at Montreal, July 28th, 1891; Educ., B.Sc., Ecole Polytechnique, 1915; 1911 and 12 (summers), chainman for F. C. Laberge; 1913 (summer), chainman, Militia Dept.; 1914 (summer), transitman and ch. of party, Militia Dept.; 1915-16, asst., topographical survey party in Can. Rockies; 1916-20, 2 yrs. dftsman and 2 yrs. transitman, C.N.R., St. Maurice div., Que.; 1920-25 div. engr., Que. Road Dept.; 1925 to date, asst. engr., Tech. Service, city of Montreal.

References: G. R. MacLeod, J. G. Caron, F. C. Laberge, C. Leluau, T. Lafreniere, H. Massue, A. Lalonde.

BOURBONNAIS—PAUL EMILE, of Montreal, Que., Born at Coteau Landing, June 16th, 1888; Educ., C.E., B.A.Sc., Laval Univ., 1914, B.A., St. Mary's College, 1910; 1910 and 11 (summers), topography, Dept. Ry. & Canals; 1912 (summer), div. surveyor's staff, C.P.R.; 1913 (summer), constrn., D.P.W., Quebec dist.; 1914 to date, with Que. Streams Comm. connected with survey investigations, regulation possibilities, design, constrn., operation of storage dams, storage investigations and studies, hydrometric studies; at present, senior staff engr.

References: O. Lefebvre, A. Duperron, H. Massue, F. C. Laberge, A. Frigon.

DICKSON—ARCHIBALD, of Winnipeg, Man., Born at Motherwell, Scotland, Mar. 21st, 1887; Educ., Dalziel High School, Motherwell, 1899-1905, Royal Tech. College, Glasgow, 1906-08; 1906-1911, dftsman, Lanarkshire Steel Co., Motherwell; 1911-12, dftsman and checker, Man. Bridge Wks., Winnipeg; 1913 to date, with Dom. Bridge Co., Wpg., 1913-18, dftsman; 1919 to date, checker.

References: H. M. White, J. M. Morton, J. Grieve, C. G. Barnes, H. J. D. Briercliffe, A. J. Dostert.

JACKSON—CHARLES H., of Riverbend, Que., Born at Toronto, June 2nd, 1901; Educ., B.A.Sc., Univ. of Toronto, 1923; 1919 (summer), rodman, Dept. Public Highways of Ont.; 1920-23 (summers), instrumentman and inspector with Dept. Public Highways of Ont. on concrete bridges, culverts, etc.; 1924, Feb. to Apl., instrumentman with W. L. Cassels, surveying mining claims; 1924, Apl. to July, clerk i/c stores, materials, payroll, etc., on conduit constrn. with J. A. Mercier Co., Detroit, Mich.; 1924-25, instrumentman and field engr., paper mill constrn., with W. I. Bishop, Ltd., & Price Bros., Ltd., Riverbend, Que.; Jan. to Aug. 1926, asst. to res. engr., paper mill constrn., at Pine Falls, Man., with Carter-Halls-Aldinger Co., Ltd., of Winnipeg; Aug. 1926 to date, asst. supt. (constrn.), paper mill constrn., Price Bros & Co., Ltd., Riverbend, Que.

References: D. J. Emrey, G. F. Layne, A. A. MacDiarmid, A. B. McEwen, P. Gillespie.

McCLELLAND—HAROLD LANGDON, of Toronto, Born at Cooksville, Ont., May 13th, 1890; Educ., B.A.Sc., Univ. of Toronto, 1917; 1916 (summer), assaying & surveying, Dome Lake; 1917 (summer), asst. surveyor, Creighton Mines; 1917-19, engr. and mill supt., Casey Cobalt Mine and Molybdenum Products Co., Wilberforce, Ont.; 1919, i/c development work, Skead Gold Syndicate; 1920-22, engr., Tightner Mining Co. & Original 16-1 Mining Co., Alleghany-Sierre Co., Calif.; 1922-26, respons. charge Manila office of Atkinscraft & Co., Inc., Zamboanga; i/c exploration work, Savant Mines, Ltd., 1927; at present, demonstrator and research asst., Dept. of Mining Engrg., Univ. of Toronto.

References: H. E. T. Haultain, A. C. Dyer, A. E. Berry, W. P. Dale, R. S. C. Bothwell, H. A. Babcock, H. L. Dowling.

McPHAIL—ALEXANDER LYALL, of St Catharines, Ont., Born at Galt, Ont., Apr. 25th, 1900; Educ., B.A.Sc., Univ. of Toronto, 1924; 1921 (summer), laying out townsite, Hollinger Gold Mines, Timmins, Ont.; May to Dec. 1924, instrumentman with Northern Devel. Branch, Huntsville, Ont.; 1925 to June 1927, asst. city engr., city of Stratford, Ont.; June 1927 to date, asst. city engr., city of St. Catharines, Ont.

References: A. B. Manson, A. Milnes, J. H. Curzon, R. W. Downie, A. L. Harkness.

RACEY—HERBERT JOHN, of Westmount, Que., Born at Chicoutimi, Que., Mar. 29th, 1904; Educ., jr. matric. and school leaving certif., Westmount High School; 1923 (summer), rodman, constrn. dept., C.P.R.; 1925 (summer), leveller, engrg. dept., Ottawa-Mtl. Power Co.; 1926 (summer), fld. dftsman and instrumentman, Shawinigan Engrg. Co.; 1927 (summer), fld. engr., Que. Terminal Station, Shawinigan Engrg. Co.; at present, student in 4th yr. C.E. course, Queen's Univ.

References: B. S. McKenzie, C. Luscombe, G. P. Cole, H. W. Racey, A. MacPhail, W. P. Wilgar, C. S. Saunders.

SAUNDERS—CLARE BRITTON, of Sault Ste. Marie, Ont., Born at Watford, Ont., Apr. 10th, 1899; Educ., 2 yrs. School of Mines, Queen's Univ., Nov. 1925 to May 1927, 12 mos. dfting room of engrg. dept., Imperial Oil Ref'y., Sarnia, and 6 mos. in combustion dept. of same company; 1927 to date, asst. city engr., Sault Ste. Marie, Ont.

References: A. H. Russell, T. Montgomery, C. B. Leaver, A. Jackson.

SCHONI—WILLY, of Peterborough, Ont., Born at Bolligeu, Switzerland, Apr. 24th, 1903; Educ., dipl. elect. engrg., Swiss Polytechnique Inst., 1926; test courses, Brown Boveri & Co.; shop practice, Kummler and Matter; at present, asst. engr., switchboard engrg dept., C.G.E. Co.

References: E. R. Shirley, W. M. Cruthers, A. B. Gates, N. D. Seaton, W. E. Ross, T. E. Gilchrist.

SPENCE—WILLIAM ARCHIBALD, of Vancouver, B.C., Born at Glenarm, Ont., Nov. 11th, 1890, Educ., B.Sc., Queen's Univ., 1917; 1912-15, instrumentman on topographic and irrig. surveys for Dom. Govt.; 1917-19, pilot in R.A.F.; 1919, asst on survey of portion of interprov. boundary, Man. & Sask., for Dom. Govt.; 1920, development work on mining properties in Northern Man.; 1921-22, i/c reconn. location and constrn. of roads and highways for Col. Govt. in Brit. Honduras; 1923, i/c plant mtce. and constrn., Whalen Pulp & Paper Co., Ltd.; 1924-25, i/c surveys for B.C. Electric Ry. Co., also 4 mos. i/c highway location for B.C. Govt.; 1926, engr. on constrn. sidewalks, sewers, retaining walls, etc., for munic. of S. Vancouver; at present, engr. for Thomson & Clark Timber Co., Ltd., i/c logging, ry. location and constrn.

References: E. A. Wheatley, Wm. Anderson, W. L. Ketchen, A. M. Narroway.

STE. MARIE—LOUIS ALEXANDRE, of Montreal, Born at Montreal, Nov. 7th, 1885; Educ., B.A.Sc., Laval Univ., 1908; 1914-17 and 1919-23, city engr., Longueuil; 1917-19, city engr., St. Hyacinthe; 1923 to date, asst. engr., technical service, city of Montreal.

References: G. R. MacLeod, J. G. Caron, L. G. Boisseau, O. Lefebvre.

FOR TRANSFER FROM ASSOCIATE MEMBER TO A HIGHER GRADE

DUPERRON—ARTHUR, of Montreal, Born at Nicolet, Que., Sept. 29th, 1889; Educ., B.A.Sc., Ecole Polytechnique, 1911; 1911 (summer), survey and office work, E. Loignan & W. E. Baucher; Sept. to Dec. 1911, topographer, ry. location, Central Ry. of Can.; Dec. 1911-Aug. 1912, hydro-electric survey; 1912-15, dftsman, constrn. and bridge depts., C.P.R.; 1915 to date, with Que. Streams Comm., as follows: i/c survey party, as res. engr., prin. asst. to ch. engr., and from 1925 to date, asst. ch. engr.

References: O. Lefebvre, A. Surveyer, F. C. Laberge, J. L. Busfield, J. A. McCrory, A. Frigon.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

KIDD—WILLIAM SIDNEY, of Ottawa, Ont., Born at Burritts Rapids, Ont., Dec. 12th, 1893; Educ., B.A.Sc., Univ. of Toronto, 1920; 1913 & 14 (summers), dftsman, Dept. of P.W., Ottawa; 1916-20, overseas service; 1920-21, dftsman and designer on pulp mill work, Riordon Co., Ltd.; 1921-22, dftsman, Dept. of Rys. and Canals, Ottawa; 1922-25, struct'l engr., J. A. Ewart, Ottawa; 1925-26, designing engr., Can. Int. Paper Co., Temiskaming; at present, asst. ch. engr., E. B. Eddy Co., Hull, Que.

References: D. A. McLachlan, L. S. Dixon, J. A. Ewart, F. M. Pratt, G. F. Taylor.

ROSE—ALEXANDER ANDREW, of Sault Ste. Marie, Ont., Born at Ailsa Craig, Ont., Apr. 14th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1923; 1922 (summer), dftsman, Code & Code, Windsor; 1923-26, instructor in dfting and maths., Sault Ste. Marie Tech. School; 1926 to date, head of tech. dept., Sault Ste. Marie Tech. School.

References: F. S. Rutherford, C. H. Speer, J. H. Jenkinson, A. H. Russell, W. S. Wilson.

WALKER—GEORGE STUART, of Ottawa, Ont., Born at Cocanada, India, Aug. 15th, 1893; Educ., B.Sc., Queen's Univ., 1922; 1922-23, asst. to div. engr., Ont. Prov. Dept. of Highways; 1924-27, Imp. Oil Co., at Negritos, Peru, 2 yrs. geological survey, remainder of period, i/c constrn. and mtce. of 200 miles of roads and 120 miles ry., inc. location, constrn. and operation; at present, on leave; 1915-19, war service with Can. Engrs.

References: R. L. Dunsmore, J. H. McLaren, J. A. H. Henderson, R. M. Smith, D. S. Ellis, W. P. Wilgar, A. MacPhail.

ZEALAND—EDWARD L., of Arvida, Que., Born at Hamilton, Ont., May 14th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1922; 1920, rodman, C.N.R.; 1921 and 1922, dftsman, instrumentman and on engrg. office work, Ont. Dept. of Highways; 1922, July to Nov., instrumentman and concrete inspector, C.P.R.; 1923-25, engr. with Que. Devel Co., Isle Maligne, on constrn. hydro-electric plant; also asst. engr. on 40-mile transmission line, topographical survey and ry. constrn., Duke-Price Power Co., Isle Maligne; 1925 to date, with Aluminum Co. of Can. at Arvida, 1 mo. i/c data on soil bearing tests and test pits, 2 yrs. asst. constrn. engr.; at present, constrn. engr. on plant constrn.

References: F. H. Cothran, D. F. Noyes, R. E. Parks, H. G. Cochrane, J. L. Guest, V. A. G. Dey, C. E. Bush.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

BEECROFT—GEORGE WILLIAM, of Toronto, Ont., Born at Lindsay, Ont., Jan. 26th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1924; 1915-19, C.E.F. Machine Gun Co. and Engrs.; 1920 (summer), asst. foreman, mtce. of way, C.N.R.; 1921 (summer), sampler, Hollinger Gold Mines, Timmins; 1922-23 and 24 (summers), dftsman and estimator, Dept. of Works, Toronto; Jan. to June 1925, asst. designer, York twp.; July 1925 to June 1926, res. engr., El Centro Tropical Oil Co., Colombia, S.A., engaged in highway constrn., preparation of well locations, tanks, pipe lines, industrial bldgs., etc.; June to Nov. 1926, asst. engr. on constrn., steam power plant, same Co.; Nov. 1926 to Aug. 1927, field engr., same Co.; at present, on vacation.

References: P. Gillespie, J. H. Curzon, C. R. Young, O. M. Falls, F. B. Goedike.

CREASE—CHARLES EDWARD, of Peterborough, Ont., Born at Amherst, N.S., Mar. 24th, 1902; Educ., B.Sc., N.S. Tech. Coll., 1925; constrn. work, H.E.P.C., Ont.; test course, C.G.E. Co.; July to Oct. 1926, transformer designing, C.G.E. Co.; 1926 to present, industrial control engrg., C.G.E. Co.

References: W. E. Ross, B. Ottewell, W. M. Cruther, B. L. Barns, W. F. McKnight, F. R. Faulkner.

GEIGER—DOUGLAS GEORGE, of Kingston, Ont, Born at Ottawa, Oct. 19th, 1900; Educ., B.Sc., Queen's Univ., 1922; 1920 (summer), shops, C.G.E. Co., Peterborough; 1922 and 1923 (summers), shops, Can. West. Co., Hamilton; Oct. 1922-May 1923, demonstrator, elect'l engrg., Queen's Univ.; Oct. 1923-May 1924, instructor in elect'l engrg.; 1924-26, transmission engr. dept., Bell Tel. Co.; Sept. 1926 to present, lecturer, elect'l engr., Queen's Univ.; engr. i/c broadcasting at Queen's Univ.

References: D. M. Jemmett, L. M. Arkley, L. T. Rutledge, A. Jackson, G. J. Smith, J. L. Clarke.

HOLMES—EVERETT ERIC, of Westmount, Que., Born at Montreal, June 17th, 1899; Educ., B.Sc., McGill University, 1922; summers of 1914-15 and 16, machinist, Sydney Shipyards, Sydney, N.S.; 1917-19, oversesa, 3rd Can. Siege Battery; May to Oct. 1919, 20 and 21, 2nd officer, S.S. Belchers, New York to Odessa, Aden and other ports; 1922-25, sec-treas. and engr., St. Lawrence Supply Co., Ltd.; 1925 to date, with Bell Telephone Co., as follows: mtce. div., general plant office, plant operations div.; and, Nov. 1926 to date, i/c service order section, plant operations, general plant dept.

References: D. F. Grahame, H. S. Petford, C. M. McKergow, C. F. Medbury, E. Brown, A. R. Roberts.

LEWIS—WILLIAM MILTON, of Port Robinson, Ont., Born at Camden, Ont., Mar. 16th, 1892; Educ., B.Sc., Queen's Univ. 1925; Sept. 1925 to present, instrumentman on Section 6, Welland Ship Canal.

References: L. M. Arkley, L. T. Rutledge, J. E. Sears, E. P. Johnson, A. Jackson, D. Jemmett.

METHE—PHILIPPE, of Quebec, Born at Henryville, Que., Dec. 7th, 1889; Educ., B.A., C.E., Ecole Polytechnique, 1915; 1917-21, operating dept. and meter dept., Shaw. Water & Power Co.; 1922-26, ch. engr., Lower St. Lawrence Power Co., Rimouski, Que.; 1926 to date, principal, Quebec Tech. School.

References: A. Frigon, F. B. Brown, A. Surveyer, A. B. Normandin, A. R. Decary, H. Cimon, A. Lariviere, L. Beaudry.

MORGAN—FREDERICK STEWART, of New York City, Born at Vancouver, Oct. 8th, 1904; Educ., B.A.Sc., Univ. of B.C., 1925; 1922 and 1923 (summers), chainman & roadman on Prov. Govt. of B.C. and city of Vancouver surveys; 1924 (summer), asst. ch. of party, city of Vanc. waterworks survey; 1925 (summer), asst. ch. of party, B.C. Elec. Ry. survey; 1925-26, with Sydney E. Junkins Co. as asst. to field engr. on constrn. of C.P.R. pier B.C. at Vancouver; 1926-27, design and detailing of steel, timber and concrete in office of S. E. Junkins Co.; June 1927 to date, designer of struct. steel and reinforced concrete in constrn. dept., Knickerbocker Ice Co., New York.

References: W. H. Powell, H. Idsarde, S. E. Junkins, J. A. Walker.

SHAW—GERALD EDISON, of Montreal, Born at Windsor, Ont., May 5th, 1901; Educ., McGill Univ., B.Sc. 1924, M.Sc. 1925; 1919-20, tracing, shop drawing corrections & dfting, Can. Bridge Co.; 1921 (summer), finish shop, assembling, Can. Bridge Co.; 1922-23 and 24 (summers), detailing, towers and bridges, same Co.; 1925 to date, designing reinforced concrete and steel structures, bridge dept., C.P.R.

References: P. B. Motley, A. R. Ketterson, H. M. MacKay, R. de L. French, F. H. Kester, A. E. West.

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A

ABRASIVE WHEELS

Developments. The Make-up of Grinding Wheels, H. Bentley. Indus. Mgmt. (Lond.), vol. 13, no. 10, Oct. 1926, pp. 441-442. Emery and corundum, the ideal grinding material; wheel wear; grade and grain; grinding metals.

Manufacture. The Manufacture of Grinding Wheels, H. A. Plusch. Ceramist, vol. 8, no. 7, Oct. 1926, pp. 429-444, 6 figs. Crushing and preparation; aluminous abrasives; plant procedure; compositions best suited for grinding; grain and grade of grinding.

ABRASIVES

Sand. Preparation of Abrasive Sand, W. M. Weigel. Abrasive Industry, vol. 7, no. 11, Nov. 1926, pp. 348-349, 6 figs. Abrasive sand is used for sand-blasting and glass grinding; improved abrasives replace sand for abrasive paper and cloth coating.

ACCELEROMETERS

Recording. Cambridge Recording Accelerometers. Mech. World, vol. 80, no. 2078, Oct. 29, 1926, pp. 347-348, 5 figs. Two-component accelerometer taking simultaneous records of accelerations in two directions perpendicular to each other.

AERIAL PHOTOGRAPHY

Mapping Camera. An Aerial Mapping Camera. Engineer, vol. 142, no. 3696, Nov. 12, 1926, p. 522, 2 figs. Camera specially devised for automatically taking aerial photographs for map-making purposes; made by Williamson Mfg. Co.

AERODYNAMICS

Lift Distribution Over Thin Wing. The Distribution of Lift Over Thin Wing Sections, C. A. Shook. Am. Jl. of Mathematics, vol. 48, no. 3, July 1926, pp. 183-203, 4 figs.

AIR CONDITIONING

Temperature, Humidity and Air-Motion Data. Practical Application of Temperature, Humidity and Air-Motion Data to Air Conditioning Problems. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 11, Nov. 1926, pp. 737-748, 8 figs.

AIRCRAFT CONSTRUCTION MATERIALS

Fusion-Joining. The Fusion-Joining of Metallic Materials Aircraft Construction, S. Daniels. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1240-1246, 6 figs.

AIRPLANE ENGINES

Gas-Starter System. The Gas-Starter System for Aircraft Engines, W. F. Nicholson. Air Ministry—Air Publication, no. 1181, Oct. 1925, 40 pp., 27 figs. System consists of charging cylinders and induction pipes with combustible gasoline-air mixture by means of small power-driven compressor unit, which pumps mixture direct into cylinders through non-return valves which are fitted in them for purpose.

Oil-Injection. Research on Oil-Injection Engines for Aircraft, W. F. Joachim. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1123-1128, 11 figs. Discusses problem of high-speed, high-capacity, oil-injection engine.

Supercharging. Supercharged Aero Engines, R. F. R. Pierce. Roy. Aeronautical Soc.—Jl., vol. 30, no. 190, Oct. 1926, pp. 615-618. Shows importance of supercharging, desirable results brought about by process, and consideration of difficulties; type of fans and method of driving them.

AIRPLANE PROPELLERS

Metal. The Durability of Metal Propellers, T. P. Wright. Aviation, vol. 21, no. 17, Oct. 25, 1926, p. 706, 1 fig.

Model, Tests of. Test of Model Propeller with Symmetrical Blade Sections, E. P. Lesley. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 246, Sept. 1926, 11 pp., 6 figs.

Tests on Thirteen Navy Type Model Propellers, W. F. Durand. Nat. Advisory Committee for Aeronautics—Report, no. 237, 1926, 17 pp., 28 figs.

AIRPLANES

Airfoils. An Investigation of the Flow of Air Around an Aërofoil of Infinite Span, L. W. Bryant and D. H. Williams. Aeronautical Research Committee—Reports and Memoranda, no. 989, Feb. 1924, 44 pp., 20 figs. Includes appendix, by G. I. Taylor, on connection between lift on airfoil in wind and circulation round it.

On the Drag of an Aërofoil for Two-Dimensional Flow, A. Fage and L. J. Jones. Aeronautical Research Committee—Reports and Memoranda, no. 1015, Nov. 1925, 14 pp., 8 figs.

Full-scale and Model Measurements of Lift and Drag of Bristol Fighter with R.A.F. 32 Wings, E. F. Anderson, L. E. Caygill and R. M. Wood. Aeronautical Research Committee—Reports and Memoranda, no. 1006, Dec. 1925, 5 pp., 7 figs.

AIRSHIPS

Drag. The Drag of Airships, C. H. Havill. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 247, Sept. 1926, 26 pp., 2 figs.

The Drag of Airships, Drag of Bare Hulls, C. H. Havill. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 248, Oct. 1926, 17 pp., 18 figs.

Research. A Review of the Present Position with Regard to Airship Research and Experiment, V. C. Richmond. Roy. Aeronautical Soc.—Jl., vol. 30, no. 190, Oct. 1926, pp. 547-582 and (discussion) 582-588, 23 figs.

Stress Calculation. On the Calculation of Stresses in the Hulls of Rigid Airships, R. V. Southwell. Roy. Aeronautical Soc.—Jl., vol. 30, no. 191, Nov. 1926, pp. 627-667, 12 figs.

ALLOYS

Aluminum. *See Aluminum Alloys.*
Brass. *See Brass.*
Copper. *See Copper Alloys.*
Iron. *See Iron Alloys.*

ALUMINUM ALLOYS

Aluminum-Silicon. The Constitution and Structure of the Commercial Aluminum-Silicon Alloys, A. G. C. Gwyer. Inst. Metals—Advance Paper, no. 404, for mtg. Sept. 1-4, 1926, 43 pp., 54 figs. Constitution, structure and mechanical properties of modified aluminum-silicon alloys. See also abstract in Foundry Trade Jl., vol. 34, no. 526, Sept. 16, 1926, pp. 247-250, 4 figs., and Engineering, vol. 122, nos. 3169 and 3170, Oct. 8 and 15, 1926, pp. 458-460 and 492-494, 10 figs.

Analysis. The Analysis of Aluminum Alloys, H. H. Shepherd. Foundry Trade Jl., vol. 34, no. 528, Sept. 30, 1926, pp. 284-286, 1 fig. Deals with aluminum-copper, aluminum-copper-tin and aluminum-zinc-copper alloys; sampling; estimation of silicon, tin and lead; separations of copper, tin and lead for their estimation.

Boron in. Boron in Aluminum and Aluminum Alloys. Metallurgist (Supp. to Engineer, vol. 142, no. 3694), Oct. 29, 1926, pp. 157-159, 1 fig. Review of paper by P. Hænni, published in Revue de Metallurgie, June 1926, giving account of research carried out by author; results of tensile and hardness tests on binary alloys of boron and aluminum; corrosion tests; it would appear that boron is not detrimental and may increase resistance of aluminum to nitric acid.

Duralumin. *See Duralumin.*

AMMONIA COMPRESSORS

Horsepower. Horsepower of Ammonia Compressors, W. H. Motz. Refrigeration, vol. 40, no. 4, Oct. 1926, pp. 43-45, 1 fig. Analysis of indicator cards to obtain indicated horse power; use of meter readings to determine input electrical horse power.

APPRENTICES, TRAINING OF

Methods. Trades Training, C. S. Coler. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1257-1260, 4 figs. Methods used in promoting trades training by Westinghouse Elec. & Mfg. Co.; development of incentives as important phase of modern apprenticeship; concludes that apprenticeship programmes can be economically operated under present conditions without discounting such items as good will and potential value of exceptional ability which may be discovered or developed.

ASBESTOS

Mining. Mining Asbestos on a Large Scale, F. A. Westbrook. Pit & Quarry, vol. 13, no. 2, Oct. 27, 1926, pp. 49-58, 18 figs. Practice and equipment of Asbestos Corp. of Thetford Mine, Que., with details on towers, quarry, crushing mill and electrical equipment.

AUTOMOTIVE FUELS

Anti-Knock Compounds. Report on Dopes and Detonation, H. L. Callendar, R. O. King and C. J. Sims. Aeronautical Research Committee—Reports and Memoranda, no. 1013, Nov. 1925, 54 pp., 15 figs. Investigation to determine physical actions that delay or prevent detonation in engine cylinder.

Future Trends. Future Trends in Automotive Fuels, A. C. Fieldner and R. L. Brown. Indus. & Eng. Chem., vol. 18, no. 10, Oct. 1926, pp. 1009-1014, 1 fig. Future fuel requirement; present trends; trend in engine and automobile design; probable trend when petroleum supply becomes inadequate; sources of petroleum substitutes; motor fuel from coal and other forms of automotive fuel.

Heavy. Experimental Investigation of the Physical Properties of Medium and Heavy Oil, Their Vapourization and Use in Explosion Engines, F. Heinlein. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 384, Oct. 1926, 22 pp., 3 figs. Experimental apparatus; vapourization speed and diffusion coefficient. Translated from Motorwagen, June 30, 1926.

AVIATION

CIVIL, UNITED STATES. Civil Aviation in the United States, A. Black. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1092-1094, 2 figs. Traces beginning of American civil aviation to establishment in 1918 of post office air-mail route between New York City and Washington, D.C., and subsequent organization of transcontinental airway; most careful estimates indicate that flying mileage on regular American air routes will, in ensuing year, far surpass that of Great Britain and France.

B

BELTING

CHARACTERISTICS. Belting of Various Materials and Its Characteristics, H. A. Flogaus. Belting, vol. 29, no. 4, Oct. 1926, pp. 15-17, 4 figs. Leather found to be best material for majority of drives; fabric and composition belts better for certain conditions.

LEATHER. Recommendations on the Application and Care of Leather Belt Drives, J. R. Hopkins. Indus. Engr., vol. 84, no. 10, Oct. 1926, pp. 464-468 and 486, 4 figs. Factors that should be considered in purchase and installation of this equipment for industrial-plant service.

BELTS

CARE AND INSTALLATION. Care and Installation of Belts. J. H. Rodgers. Machy. (N.Y.), vol. 33, no. 3, Nov. 1926, pp. 166-168, 5 figs. Care necessary in making joint; belt dressing should be used sparingly; direction of belt travel; example of faulty practice.

BEARINGS

BABBITTING. Electrically-Heated Babbitting Process. Elec. World, vol. 88, no. 20, Nov. 13, 1926, pp. 1019-1020, 1 fig. Describes first complete installation by street railway of electrically-heated babbitting equipment installed by Los Angeles Railway; installation consists of three electrically-heated and automatically-controlled General Electric melting pots and preheating oven.

BLASTING

COAL MINES. Blasting Bottom Rock Along Coal Mine Haulage Ways, W. J. German. Modern Min., vol. 3, no. 10, Oct. 1926, pp. 333-334, 5 figs. Method for speed and economy.

BOILER FEEDWATER

DISSOLVED OXYGEN RECORDER. Recorder for Dissolved Oxygen in Feedwater. Engineering, vol. 122, no. 3174, Nov. 12, 1926, p. 610, 2 figs. Instrument, known as Cambridge dissolved oxygen recorder, gives continuous record of quantity of oxygen present in feedwater on chart calibrated in cubic centimetres per liter so that defects in feed system which might otherwise remain unnoticed for long periods may be instantly detected and remedied.

FOAMING AND PRIMING. Present Knowledge of Foaming and Priming of Boiler Water, with Suggestions for Research, C. W. Foulk. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1364-1367. Progress report of Sub-Committee No. 3 of Joint Research Committee on Boiler Feedwater Studies on zeolite softeners, internal treatment, priming and foaming and electrolytic scale prevention.

HYDROGEN-ION CONCENTRATIONS. The Potentiometric Determination of Hydrogen-Ion Concentration as Applied to Boiler Waters, W. N. Greer and H. C. Parker. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1129-1132, 7 figs. Methods of controlling boiler water or boiler feedwater.

PRETREATMENT. Pretreatment of Boiler Feedwater, C. R. Knowles. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1361-1363. Progress report of Sub-Committee No. 2 of Joint Research Committee on Boiler Feedwater studies on water softening by chemicals (external treatment).

BOILER FURNACES

GRATES. Calculation of Grate Surface of a Furnace Berechnung der Rostfläche einer Feuerung), R. Günther. Feuerungstechnik, vol. 14, no. 24, Sept. 15, 1926, pp. 288-291. Shows what great influence steam and load conditions have on dimensioning of grate surface and how grate size must be adapted to these conditions.

INTERCHANGEABLE OIL AND GAS BURNERS. Oil and Gas Burners are Interchangeable. Power Plant Eng., vol. 30, no. 22, Nov. 15, 1926, pp. 1200-1202, 6 figs. Interesting results obtained in furnaces where gas burners can be replaced on short notice with oil burners at plant of Kansas Gas & Electric Co. at Wichita, Kan.

BOILER OPERATION

LOAD DETERMINATION. Measuring Boiler Load Without Flow Meters, J. D. Jenkins. Power, vol. 64, no. 18, Nov. 2, 1926, p. 658. Author makes use of principle that what comes in, minus what goes out, must equal what stays; this principle is applied to dissolved solids in water entering boiler; from analysis of feed and boiler waters and knowledge of time, boiler has been on and quantity of blowdown, evaporation can be calculated.

BOILER PLATE

BENDING PRESS FOR. Vertical Bending Press for Boiler Plates, Weil. Eng. Progress, vol. 7, no. 9, Sept. 1926, pp. 253-254, 3 figs. Design developed by Schiess-Defries, Düsseldorf, for electric drive; chief advantage of this process, compared with bending rolls, is that plates can be completely bent in one operation.

ELASTIC STRAIN. Calculating Elastic Strains (Calcul des tensions élastiques), E. Francken. Revue Universelle des Mines, vol. 11, nos. 5 and 6, and vol. 12, no. 2, Sept. 1, 15 and Oct. 15, 1926, pp. 230-238, 262-273 and 49-63, 14 figs. Discusses boiler resistance; calculates strains in plates of cylindrical horizontal boiler, starting from fundamental equation of fatigue of metal; determination of section of greatest fatigue.

EMBRITTLEMENT. The Cause and Prevention of Embrittlement of Boiler Plate, S. W. Parr and F. G. Straub. Univ. of Illinois Bul., vol. 23, no. 42, June 23, 1926, pp. 7062, 50 figs.

INTERCRYSTALLINE CRACKS. A New Boiler Steel and Intercrystalline Cracks. Power, vol. 64, no. 17, Oct. 26, 1926, p. 623. Experiments with new boiler steel and cause of intercrystalline cracks were discussed at two meetings recently held in Europe, that of Association of Steam Boiler Inspectors at Zürich, Switzerland, and that of Association of Large Steam Boiler Plants at Cassel, Germany.

BOILERS

CORROSION. Boiler Corrosion and Possible Combative Measures, W. M. Barr and R. W. Savidge. Chem. & Met. Eng., vol. 33, no. 10, Oct. 1926, pp. 607-608, 6 figs. Effect of strained metal, scale-forming constituents, dissolved oxygen and causticity, with special reference to locomotive practice. (Abstract.) Paper read before Am. Inst. Chem. Engrs.

FUSION WELDING. Recommended Standing Practices and Standards. Boiler Maker, vol. 26, no. 11, Nov. 1926, pp. 321-326, 5 figs. Action taken at annual meeting of Master Boiler Makers' Assn. on fusion-welding practice.

WASTE-HEAT. A New and Unique Type of Waste-Heat Boiler, W. S. Anderson, Jr. Gas Age-Rec., vol. 58, no. 15, Oct. 9, 1926, pp. 489-491, 3 figs. La Mont boiler is described from gas makers' point of view; it is being offered in combination with La Mont steam sealed hot valves and outlet clapper valve.

WATER-TUBE. *See Boilers, Water-Tube.*

BOILERS, WATER-TUBE

TESTS. Boiler and Stoker Tests at the High Bridge Station, D. J. Mosshart. South. Power Jl., vol. 44, no. 10, Oct. 1926, pp. 52-57, 6 figs. Data of boiler and stoker test on four 18,722-sq. ft. water-tube boilers.

BORING MILLS

VERTICAL. Large Single-Column Vertical Boring Mill with Standard Adjustable on Bed. Machy. (Lond.), vol. 29, no. 733, Oct. 28, 1926, pp. 111-114, 10 figs. Machine built by Schiess-Defries Co., Düsseldorf, consists of large base and table, column which is movable on bed and carries vertical sliding support and arm which is fastened to column supported on horizontal V-ways.

BRAKES

MACHINE TOOLS, APPLICATION TO. The Application of Brakes to Industrial Machinery, F. C. Stanley. Am. Mach., vol. 65, no. 20, Nov. 11, 1926, pp. 779-781, 5 figs. Claims that machine tools are usually inadequately provided with brakes; function of brake; types of brake suitable for machinery; methods of application; advantages.

BRASS

WORKING PROPERTIES. The Working Properties of Brasses. Brass World, vol. 22, no. 10, Oct. 1926, pp. 325-326, 1 fig. German metallurgists report on investigations with many types of brass; hot-rolling problem when impurities are present in appreciable quantities. Translated from Zeit. für Metallkunde.

BREAKWATERS

CAPE BALD, NEW BRUNSWICK. Construction of Cape Bald Breakwater, G. Stead. Can. Engr., vol. 51, no. 16, Sept. 19, 1926, pp. 557-559, 5 figs. Breakwater built at Point du Chene by Department of Public Works to protect shipping; inter of structure built of creosoted timber and filled with stone ballast; exterior of reinforced concrete and concrete caissons.

BRIDGES, CONCRETE

ARCH. Engineering and Architectural Design of a Long Concrete Bridge, W. E. King and R. C. Jones. Eng. News-Rec., vol. 97, no. 19, Nov. 4, 1926, pp. 732-735, 4 figs. Robert Street Bridge at St. Paul has 264-ft. two-rib arch channel span flanked by five-rib and barrel arch spans; structural steel in main spans. See also article by J. F. Greene in same journal, no. 20, Nov. 11, 1926, pp. 785-788, 2 figs, on construction methods employed.

The Reduction of Deformation Stresses in Fixed Concrete Arches, J. F. Brett. West. Soc. Engrs.—Jl., vol. 31, no. 9, Sept. 1926, pp. 351-366, 10 figs. Analysis of stresses in concrete arch bridge with description of method of compensation which results in longer spans, lighter sections and greater safety; this also means lighter falsework and less trouble with foundations; spans of 2,000-ft. length are predicted having low ratio of rise.

BRIDGES, HIGHWAY

DESIGN. Highway Bridge Design in Saskatchewan, H. R. Mackenzie. Can. Engr., vol. 51, no. 17, Oct. 26, 1926, pp. 587-588 and 39, 1 fig. Standard practice employed in construction of various bridges and culverts in province; list of permanent structures built since 1919, giving location, type, cost and principal dimensions.

BRIDGES, LIFT

BASCULE. Bascule Bridge with All Mechanism Below the Deck. Eng. News-Rec., vol. 97, no. 17, Oct. 21, 1926, pp. 666-670, 8 figs. Six-track bridge having 85-ft. plate-girder deck span, with all operating machinery and counterweights housed below rail level, was built in 1925 by Illinois Central Railroad for its crossing of Little Calumet River at Riverdale, south of Chicago.

Electric Control Equipment for a Bascule Bridge. Engineer, vol. 142, no. 3694, Oct. 29, 1926, pp. 480-481, 3 figs. Details of controlling equipment, manufactured by Electric Control, Ltd., Glasgow, for electric-operation bascule span at Vancouver.

BRIDGES, MOVABLE

CONTROL. Control Equipment for Movable Highway Bridges, H. H. Vernon. Gen. Elec. Rev., vol. 29, no. 11, Nov. 1926, pp. 805-813, 8 figs. Leaf-motor control; drum and magnetic type; a.c. and d.c. equipment; control for gate; lock and pump motors.

BRIDGES, RAILWAY

CONCRETE. What the D. L. & W. is Doing in Concrete Design, M. Hirschthal. Ry. Rev., vol. 79, nos. 15 and 16, Oct. 9 and 16, 1926, pp. 527-531 and 587-591, 23 figs. Account of successful use of precast-slab spans.

TIMBER FRAMING. The Framing of Bridge Timbers Before Treatment, E. Stimson. Ry. Eng. & Maintenance, vol. 22, no. 11, Nov. 1926, pp. 464-466. After treatment, nothing should be done to timbers that will penetrate heavily-treated outer zone and expose lighter-treated interior; to prevent this, it has become the practice to adze and bore-cross ties before treatment, and, with better reason, all bridge ties and timbers should be framed, sized or cut to lengths, as case may be, before treatment.

BRIDGES, WOODEN

RAILWAY. Committee VII—Wooden Bridges and Trestles. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 288, Aug. 1926, pp. 1-75. Grading rules and classification of timber and lumber for railway uses; commercial names for lumber and timber cut from principal species of softwoods; standard lumber abbreviations; American lumber standards for softwood lumber; structural grades of lumber and timber and method of their derivation; specifications for structural joist, plank, beams, stringers and posts; coded specifications for structural grades; tables of working stresses; safe loads for wooden columns.

BUILDINGS

HURRICANE, EFFECT OF. Hurricane Effects on Buildings at Hollywood, Florida, G. M. Beerbower. Eng. News-Rec., vol. 97, no. 19, Nov. 4, 1926, p. 752. Construction weaknesses evident on minor structures; roof and wall failures due to lack of anchoring.

BUSBARS

TUBULAR COPPER. Design of Tubular Copper Buses, V. R. Bacon. Elec. World, vol. 88, no. 21, Nov. 20, 1926, pp. 1066-1068. Selection of proper sizes of copper tubing to meet any given set of conditions with reference to mechanical loading aided by use of suitable tables.

C

CABLES, ELECTRIC

BARE. Current-Carrying Capacity of Bare Cables, W. W. Woll and J. A. Gable. Elec. Jl., vol. 23, no. 11, Nov. 1926, pp. 557-559, 6 figs. Results of series of tests made in Electrical Engineering Department of Massachusetts Institute of Technology to determine which formulas conform more closely to actual laboratory results; results of tests do not conform accurately with either of current-carrying capacity formulas for cables of all sizes and temperatures, although Luke's formula gives values which are much closer than Pender's.

CAMS

CIRCULAR-ARC. Graphical Analysis of Circular-Arc Cams, G. L. Guillert. Am. Mach., vol. 65, no. 18, Oct. 28, 1926, pp. 715-717, 4 figs. Graphical construction of velocity and acceleration curves for flat-faced cam, cam with offset roller, and one with pivoted follower; design of automotive cam.

CAR DUMPERS

COAL. A Large Coal-Shipping Machine or Car Dumper. Engineer, vol. 142, no. 3694, Oct. 29, 1926, pp. 469-470, 6 figs., partly on p. 472. Details of car dumper installed at Toledo on Lake Erie for Ohio Central Railroad, most powerful machine of its kind yet built.

ELECTRIC. Balanced Cradle in Car Dumper. Iron Age, vol. 118, no. 21, Nov. 18, 1926, pp. 1410 and 1452, 1 fig. Electrical and largely automatic control features machine at Toledo for handling 120-ton cars.

CARS

STEEL, REPAIRING. The Fabrication of Steel Car Parts. Ry. Mech. Engr., vol. 100, no. 11, Nov. 1926, pp. 673-675, 6 figs. Description of equipment and some of methods used at L. & N. shops, South Louisville, Ky.

CASE-HARDENING

DISTORTION. Predicting the Distortion of Heat-Treated Case-Hardened Rings, P. J. Haler. Engineering, vol. 122, no. 3170, Oct. 15, 1926, pp. 470-471, 2 figs. Points out that one of greatest drawbacks to extended use of case-hardened parts is distortion; presents charts showing maximum and minimum allowance which is to be left in bore of mild-steel work that is to be case-hardened before grinding; local distortion may be caused by unequal heating in furnace or pieces of scale adhering to piece during quenching; various factors help to give rapid cooling, such as high temperature of quenching, etc.

ROTARY MACHINES FOR. Rotary Machines for Carburizing, F. S. O'Neil. Iron Age, vol. 118, no. 21, Nov. 18, 1926, pp. 1407-1409, 3 figs. Greater uniformity of product reported; cost figures given; advantages from subsidiary uses.

CAST IRON

ELEMENTS, INFLUENCE OF. Some Grey Iron Problems, J. Shaw. Am. Foundrymen's Assn.—Advance Paper, no. 19, for mtg. Sept. 27-Oct. 1, 1926, 41 pp., 34 figs. Considers influence of sulphur and manganese on structure of cast iron containing ordinary amounts of other usual elements; deals with influence of carbon and silicon, in conjunction with other elements in structure; points out usefulness of various chill tests to practical man for judging roughly ultimate structure of molten metal before casting; form of sulphur in cast iron; discusses various views accounting for differences in loss of depth of chill between test pieces and results secured in rolls; effect of ratio of carbon to silicon on structure as judged by chill tests. See also Foundry, vol. 54, nos. 19 and 20, Oct. 1 and 15, 1926, pp. 767-772 and 825-829, 34 figs.

IMPROVEMENT. Superior Cast Iron, H. H. Schmidt and Irresberger. Eng. Progress, vol. 7, no. 9, Sept. 1926, pp. 243-245, 8 figs. Pearlite-graphite iron and its properties; improvement of cast iron by jolting and shaking process.

PEARLITIC. Perlit Cast Iron. Mech. World, vol. 80, no. 2074, Oct. 1, 1926, p. 266. Discusses properties of special cast iron invented in Lang foundries, Germany; method consists of casting irons of suitable composition in heated moulds; points out that absence of really decisive quantitative information makes it difficult to estimate advantages of preheated mould, but they do not appear to be of very great order.

CEMENT

LUMNITE. Lumnite Cement in Concrete Construction, H. W. Bille. Minn. Federation of Architectural & Eng. Societies—Bul., vol. 11, no. 10, Oct. 1926, pp. 14-18. New hydraulic cement for concrete and mortar.

CEMENT, CONCRETE

SPECIFICATIONS. British Specifications for Portland Cement and Concrete. Concrete, vol. 29, no. 5, Nov. 1926, pp. 45-47. Specifications adopted last year show greater stringency, finer grinding, higher hydraulic modulus, greater compressive strengths; increase in amount of permissible magnesia; specifications for materials; proportioning and mixing of concrete.

CEMENT, PORTLAND

RESEARCH. Old and New Portland Cement Research, E. Shaw. Rock Products, vol. 29, no. 22, Oct. 30, 1926, pp. 48-50, 6 figs. Crude methods of early days in Lehigh Valley and intensive study of cement of to-day compared.

CENTRAL STATIONS

COLUMBUS, OHIO. New Station at Columbus Embodies Many Refinements. Power, vol. 64, no. 20, Nov. 16, 1926, pp. 724-728, 7 figs. Planned for ultimate capacity of 150,000 kw., new Picway station with initial installation of two 30,000-kw. units, is provided with stoker-fired boilers capable of operating up to 450 per cent of rating; motor-driven auxiliaries, bled steam, evaporators, preheaters and economizers are factors in heat balance.

COST ACCOUNTING. Power-Station Accounting for Industrial Plants, W. R. Herod. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1347-1357, 11 figs. Particulars of system of procedure that has been employed satisfactorily with but minor modifications for over three years in seven factory plants.

ENGLAND. Extensions to the Derby Corporation Electricity Works. Engineering, vol. 122, no. 3172, Oct. 29, 1926, pp. 545-547, 10 figs., partly on p. 540. Station now contains one 750-kw. d.c. machine running at 1,800 r.p.m.; three 2,000-kw., one 4,000-kw., one 750-kw. and one 10,000-kw., all a.c. machines and running at 3,000 r.p.m.

The Thorpe Power Station of the Norwich Corporation. Engineering, vol. 122, no. 3173, Nov. 5, 1926, pp. 576-578, 2 figs. Boiler house contains four Stirling boilers, two of which are fitted with Underfeed Type A travelling-grate stokers and other two with Erith-Roe retort stokers; chimneys are of steel-plate construction; the two turbo-generator sets were constructed by British Thomson-Houston Co., and are each of 5,000-kw. capacity, generating 3-phase current at 6,600 volts and 50 cycles frequency.

CHAINS

MANUFACTURE. Create Special Chain Department, B. Finney. Iron Age, vol. 118, no. 19, Nov. 4, 1926, pp. 1269-1270, 4 figs. To meet demand for special material without interfering with normal production of standard chain, Diamond Chain & Mfg. Co., Indianapolis, has "Special Department" which functions independently of remainder of plant.

The Development of Chain Making in Europe, M. A. Irmischer. Wire, vol. 1, no. 6, Oct. 1926, pp. 187-189 and 207-210, 9 figs. Review of developments.

CHARTS

H.C.T.C. GRAPHER. H.C.T.C. Grapher, M. G. Malti. Sibley Jl. of Eng., vol. 40, no. 7, Oct. 1926, pp. 112-114, 4 figs. This is name of device designed by author for graphical performance of following operations; determination of hyperbolic functions, determination of circular functions, solution of triangles, and conversion of complex numbers from orthogonal to trigonometric or experimental form and vice versa.

CHROME STEEL

PROPERTIES. High-Chromium Irons and Steels for Severe Service, T. H. Nelson. Chem. & Met. Eng., vol. 33, no. 10, Oct. 1926, pp. 612-613, 2 figs. Stainless steels have extremely wide range of properties which make them adaptable to unusual problems in chemical and allied industries.

CHUCKS

INDEXING. Indexing Chucks for the Turret Lathe. Machy. (N.Y.), vol. 33, no. 3, Nov. 1926, pp. 169-170, 5 figs. Chucks that enable both ends of part to be machined in one operation.

CITY PLANNING

ARVIDA, QUEBEC. Building the City of Arvida, H. R. Wake. Eng. Jl., vol. 9, no. 11, Nov. 1926, pp. 461-464, 1 fig. General planning, construction methods and details of materials and equipment used.

ZONING. Town and Regional Planning Problems, G. L. Pepler. Can. Engr., vol. 51, no. 14, Oct. 5, 1926, pp. 349-351. Practical problems encountered and difficulties in way of putting town plans into effect. Address delivered at Instn. of Mun. County Engrs.

COAL

CARBONIZATION. Economic Side of Low-Temperature Carbonization, O. J. Parker. Iron & Coal Trades Rev., vol. 113, no. 3056, Sept. 24, 1926, p. 456. Reference to work carried out under direction of R. Delkeskamp, Neubalelsberg, Germany, where there is very complete organization for testing and practical demonstration work, main object being better utilization of non-coking and low-grade coals, both in form of lumpy coal and slack. Abstracted from South Wales Inst. of Engrs.—Proc.

Low-Temperature Carbonization: The Economic Side, O. J. Parker. S. Wales Inst. of Engrs.—Proc., vol. 42, no. 4, Sept. 16, 1926, pp. 403-410. Author deals with problem of disposing of smalls and slack of non-coking coals, based on results of experiments carried out in Germany, where large quantities of lower grades of fuel exist, and where much study has been given to stubject.

Low-Temperature Carbonization Methods. Chem. Age, vol. 15, no. 380, Oct. 9, 1926, pp. 346-347. Salermo process involves new type of retort which belongs to class of externally heated retorts with continuous feed, material heated undergoing continuous and regular stirring; integral part of process is predrying by means of waste heat of material to be carbonized .

The Low-Temperature Carbonization of Coal, A. C. Fieldner. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1217-1227, 16 figs. Statement of fundamental principles involved and brief discussion of present status of representative types of processes.

COKING PROPERTIES. The Coking Properties of Coals, F. Fischer, H. Broche and J. Strauch. Fuel, vol. 5, no. 10, Oct. 1926, pp. 466-475, 12 figs. Experiments show that coals can be deprived of those constituents which determine caking and swelling.

DISTILLATION. The Distillation of Coal, W. H. Blauvelt. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1210-1212. Principles involved in high- and low-temperature processes of carbonizing coal, difference in products obtained therefrom, and fields for each process.

Distillation Products of Coal. Nat. Elec. Light Assn.—Report, no. 26-5, Feb. 1926, 22 pp., 6 figs. Reviews leading processes and discusses their utility as sources of either domestic smokeless fuel or of coke suitable for powdered-coal furnaces; hydrogenation of coal and synthetic motor fuels from coal.

GASIFICATION. Complete Gasification of Bituminous Coal, R. S. McBride. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1213-1216. Discussion of fundamental technology and economics of gaseous-fuel supply, dealing with present status and possibilities of systems available for making gas for use in mechanical and chemical-process industries.

PULVERIZED. *See Pulverized Coal.*

X-RAY ANALYSIS. The Application of X-Rays to the Laboratory Jig-Testing of Coal, C. N. Kemp. S. Wales Inst. of Engrs.—Proc., vol. 42, no. 4, Sept. 16, 1926, pp. 411-437, 14 figs. Describes apparatus which is modified Henry tube adapted for X-ray inspection; jig test may be applied to control of deliveries of washed small coal either by producer or purchaser; results tend to show that by employment of X-rays in conjunction with suitably designed experimental jigs of larger dimensions, valuable data would be obtained regarding separation, and in some directions, at least, without necessity of having recourse to chemical analysis. Bibliography.

COAL HANDLING

CENTRAL STATIONS. Coal and Ash Handling. Nat. Elec. Light Assn.—Report, no. 26-8, Mar. 1926, 20 pp., 32 figs. Coal- and ash-handling developments during year. Bibliography.

HOISTS. New Hydraulic-Electric Coal Hoists at Cardiff. Engineer, vol. 142, no. 3691, Oct. 8, 1926, pp. 385-388, 7 figs. Coal-handling installation is laid out over 900-ft. length of quay wall, which is now served by 5 groups of railway lines; equipped with four 30-ton coal hoists and four 30-ton car traverses.

HYDRAULIC UNLOADING. Hydraulic Unloading of Coal Trucks for Power Houses, P. Calfas. Indus. Mgmt. (Lond.), vol. 13, no. 10, Oct. 1926, pp. 424-425, 3 figs. System employed at St. Ouen, Paris, on banks of River Seine. Abstract translated from Génie Civil.

PLANTS. Coal-Handling Plant at Liverpool Corporation Electricity Works. Eng. & Boiler House Rev., vol. 40, no. 4, Oct. 1926, pp. 184-186, 1 fig. All coal-handling at station is received by rail and deposited into two lines of specially designed reinforced-concrete silos having total capacity of 1,000 tons and total length of 225 ft.; arrangement is such that 20-ton steel railway cars can run over and along top of silos and by means of hopper bottoms deposit their contents into silos below; silos feed two belt conveyors by means of travelling chute for each belt.

COAL MINES

MANAGEMENT. Mine Management and Its Relation to Safety and Efficiency, L. W. Brown. Min. Congress Jl., vol. 12, no. 11, Nov. 1926, pp. 795-797 and 827. Much responsibility must be placed upon foreman, who should have efficient organization to help plan safety work and to direct him, as well as to put these plans into effect; suggested outline as to how coal may be produced with minimum of accidents.

ROOF CONTROL. Roof Control with Underground Conveyors, D. R. Morgan. Min. Congress Jl., vol. 12, no. 16, Oct. 1926, pp. 749 and 752. Practical experience in working of conveyor shows that faces of modern length are most successful; also there is limit to speed at which face can advance.

SAFETY IN. General Safety in and About the Mines, C. A. McDowell. Min. Congress Jl., vol. 12, no. 11, Nov. 1926, pp. 798-804 and 827, 6 figs. Gives definite schedule of procedure in detail in case of mine fire or explosion adopted by Davis Coal & Coke Co.

COAL MINING

Coal-Face Machinery, Electric Drive. The Applications of Machinery at the Coal Face, S. Mavor. Instn. Elec. Engrs.—Jl., vol. 64, no. 358, Oct. 1926, pp. 989-1003, 8 figs. Outlines evolution and early history of coal cutters, later developments of these machines, and leading characteristics of bar, chain and disc coal cutters; conveyors for underground use; respective spheres of electricity and compressed air for actuating coal-face machinery are indicated.

Shearing. Is It Advantageous to Centre-Shear the Face? J. H. Emrick. Coal Age, vol. 30, no. 15, Oct. 7, 1926, pp. 495-496, 1 fig. Under certain conditions, particularly in narrow work, kerf may well be made in centre of face; wherever conditions will permit of its being used, a shear cut in conjunction with undercut results in increased production of lump coal.

COAL STORAGE

Bunkers. Reinforced-Concrete Coal Bunkers. Eng. & Boiler House Rev., vol. 40, no. 4, Oct. 1926, pp. 176-180, 3 figs. Special reference to 10,000-ton bunker at Greenwich power station of London County Council Tramways Department.

COAL WASHING

Washers. The Cleaning of Coal, W. R. Chapman and R. A. Mott. Fuel, vol. 5, no. 10, Oct. 1926, pp. 422-435, 13 figs. Various types of upward current washers.

COMBUSTION

Catalytic. Studies Upon Catalytic Combustion. W. A. Bone. Royal Soc.—Proc., vol. 112, no. A762, Oct. 1, 1926, pp. 474-499, 4 figs. Influence of steam upon catalytic combustion of carbonic oxide.

COMPRESSED AIR

Pipe-Line Transmission. Transmission of Compressed Air in Pipe Systems, J. Sarvaas. Chem. Eng. & Min. Rev., vol. 18, no. 216, Sept. 6, 1926, pp. 489-491, 1 fig. Points out that careful consideration should be given to design of pipe systems so that losses may be reduced to minimum.

CONCRETE

Aggregate Specifications. Specifications for Local Aggregates for Concrete. Engrs'. Soc. West. Pa.—Proc., vol. 42, no. 6, July 1926, pp. 295-311 and (discussion) 312-322, 9 figs. Specifications for coarse and fine aggregates.

Chemical Resistance of. Concrete as a Chemically Resistant Material of Construction. Chem. & Met. Eng., vol. 33, no. 10, Oct. 1926, pp. 631-633, 2 figs. Fireproofness, resistance to wear and inertness to many common reagents make either plain or surfaced concrete economical.

Permeability. The Permeability of Portland Cement Concrete. Engineering, vol. 122, no. 3174, Nov. 12, 1926, p. 617. Results of series of investigations into conditions, both in preparation and use, which affect extent to which building materials can resist penetration by water.

CONCRETE CONSTRUCTION

Repairing. Methods of Repairing Disintegrated or Poor Concrete. Ry. Eng. & Maintenance, vol. 22, no. 11, Nov. 1926, pp. 462-464, 4 figs. Report of committee before Am. Ry. Bridge & Bldg. Assn.

CONCRETE, REINFORCED

Reinforced Cement. The Development of Concrete Reinforcement, A. E. Lindau. Concrete, vol. 29, nos. 4 and 5, Oct. and Nov. 1926, pp. 34-38 and 22-24, 32 figs. Early uses of concrete and of reinforcement; types of early reinforcement systems. Nov.: Developments from 1900 to present time; discusses present and probable future tendencies in development.

CONDENSERS, STEAM

Operation. Some Results of Condenser Operation, E. B. Ricketts. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1312-1314, 8 figs. Results of year's operation of four condensers differing radically in design, but operated under same water conditions and under same supervision.

Regenerative. A Large Generative Surface Condensing Plant. Engineer, vol. 142, no. 3695, Nov. 5, 1926, pp. 506-508, 6 figs. partly on p. 500. With object of investigating condenser performance in general, G. and J. Weir, Glasgow, caused to be constructed inverted surface condenser with two-pass cooling-water arrangement, air being extracted from top of condenser.

Water Distribution. Condenser Study Shows Bad Water Distribution, J. J. Grob and N. Artsayooloff. Power, vol. 64, no. 19, Nov. 9, 1926, pp. 702-705, 6 figs. Studies on one of main condensers in Hell Gate plant indicate that more attention should be given to design of water side of condenser, to secure more uniform distribution among tubes; steam-flow conditions can also be improved.

CONVEYORS

Belt. Extensive Belt Conveyor System for Iron Ore Concentration Plant. Indus. Mgmt. (Lond.), vol. 13, nos. 9 and 10, Sept. and Oct. 1926, pp. 392 and 434, 3 figs. Sept.: Use of belt conveyors in coarse crushing and roll crushing plant. Oct.: Fine grinding plant.

COPPER ALLOYS

Copper-Beryllium. The Copper-Beryllium Alloys, M. G. Corson. Brass World, vol. 22, no. 10, Oct. 1926, pp. 314-320, 27 figs. Tests with rare metal show its possibilities as hardening agent for copper; in some proportions, product is similar to gold in colour; resists tarnishing.

COPPER DEPOSITS

Quebec. An Excursion Into Rouyn, A. B. Parsons. Eng. & Min. Jl., vol. 122, nos. 18 and 19, Oct. 30 and Nov. 6, 1926, pp. 684-691 and 724-730, 24 figs. Scientific prospecting features activity in Quebec's copper-gold area; Noranda's Horne mine. Nov. 6: Construction of railroad and Noranda's new smelter.

CORROSION

Iron and Zinc. Effect of Temperature on Liberation of Hydrogen Gas by Corrosion of Iron and Zinc, J. R. Baylis. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1133-1134, 4 figs. Progress report on one phase of study of effect of temperature on corrosion; corrosion of iron in absence of oxygen; corrosion of zinc.

COTTON

Fabrics, Thermal Properties...An Experimental Method for Investigating the Thermal Properties of Cotton Fabrics, J. Gregory. Textile Inst.—Jl., vol. 17, no. 10, Oct. 1926, pp. T553-T566, 11 figs. Study of effect of moisture content of fabric on its transmitting and reflecting powers, etc.

COTTON MILLS

Power Losses. Power Losses in Cotton Textile Mills, G. Wrigley. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1103-1104, 2 figs. Deals with power losses within mill and suggests difficulties and possibilities of reduction.

CUPOLAS

Heat Balance. The Heat Balance of a Cupola of the Sulzer Type. Sulzer Tech. Rev., no. 3, 1926, pp. 4-11, 12 figs. Results of series of tests on large scale carried out in foundry at Winterthur, Switzerland.

Melting Synthetic Iron. Melting Synthetic Iron in the Cupola, F. Hudson. Foundry, vol. 54, no. 21, Nov. 1, 1926, p. 857. Describes practice in melting metal produced from all-steel charge.

CUTTING METALS

Elements of. A Research in the Elements of Metal Cutting, O. W. Boston. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 95 pp., 83 figs. Investigation in fundamental elements of metal cutting conducted in Machine Tool Laboratory at University of Michigan. Bibliography.

CUTTING TOOLS

Resistance of Metals to. Work-Hardening Properties of Metals, E. G. Herbert. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 43 pp., 37 figs. Seeks to bring into correlation with operation of cutting tools certain groups of well established and generally recognized facts.

Rough Turning. Rough Turning, with Particular Reference to the Steel-Cut, H. J. French and T. G. Digges. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 69 pp., 22 figs. Tests extend to current commercial high-speed tool and structural alloy steels and portions of Taylor's original investigations in rough turning carbon steels.

CYLINDERS

Hollow, Cold Working of. The Strengthening of Hollow Cylinders by Cold-work. Metallurgist (Supp. to Engineer, vol. 142, no. 3694), Oct. 29, 1926, pp. 155-156. Refers to accounts of early development of process as applied to guns, especially of work by Jacob on process known as "autofrettage" or self-shrinkage.

DAMS

Experimental Arch. Experimental Arch Dam Under Test Shows Anomalous Distortion. Eng. News-Rec., vol. 97, no. 21, Nov. 18, 1926, pp. 828-829. Preliminary statement on results of tests of Stevenson Creek experimental dam.

DEVELOPMENTS

Interconnection. Engineering vs. Banker Efficiency in Hydro Developments, A. Pfaff. Elec. World, vol. 88, no. 20, Nov. 13, 1926, pp. 1005-1007, 1 fig. Points out that interconnected plants absorb load fluctuations better and afford more permanent service; efficiency in terms of engineer and banker differs in meaning.

DIELECTRICS

Power Factor Measurement. Standards for Measuring the Power Factor of Dielectrics at High Voltage and Low Frequency, H. L. Curtis. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1084-1086, 1 fig. Points out need for use in measurement of dielectric loss; at present most laboratories make use of air condensers; these are classified and certain sources of error which must be guarded against are mentioned; condensers with solid dielectrics would be much more convenient, more portable and cheaper, but so far none have been produced which have satisfactory constancy for use as standards at high voltage.

D

DIES

Bending. Rules for Laying Out Bending Dies. Am. Mach., vol. 65, no. 19, Nov. 4, 1926, p. 773, 7 figs. Development of blanks. Reference-book sheet.

Die-Sinking Machines. Die-Sinker Makes Cherrying Cuts Without Special Attachments. Automotive Industries, vol. 55, no. 19, Nov. 4, 1926, pp. 776-777, 4 figs. Also Am. Mach., vol. 65, no. 20, Nov. 11, 1926, pp. 803-804, 2 figs. Oscillating head is feature of new Pratt & Whitney No. 3-A universal machine; ordinary die sinking, without changes in set up, can also be done by binding head; six-spindle speeds are available.

DIESEL ENGINES

Airless-Injection. Compressorless Diesel Motors, H. Meurer. Motorship (Lond.), vol. 7, no. 74, May 1926, pp. 57-59, 10 figs. Analysis of marine oil engines of airless-injection type, with special reference to Deutz motor of this design.

Central Stations. An Economic Problem Solved by Diesel Engines. Power, vol. 64, no. 21, Nov. 23, 1926, pp. 772-773, 1 fig. Three Worthington engines have been installed in power plant of city of Horton, Kan.

Heavy-Oil. A 600-B.HP. Heavy-Oil Engine. Engineer, vol. 142, no. 3696, Nov. 12, 1926, pp. 532-533, 4 figs. New type of vertical four-stroke-cycle, single-acting, heavy-oil engine designed by Belliss & Morcom for industrial and marine auxiliary use.

Producer-Tar-Fired. Internal Combustion Engines, M. Jaretzky. Eng. Progress, vol. 7, no. 9, Sept. 1926, pp. 241-242, 4 figs. Maschinenbau A. G. (L. Schwartzkopff), Berlin, Germany, has succeeded in employing lignite tar as fuel for Diesel engine.

Supercharging. New Developments in Supercharging. Motorship (Lond.), vol. 7, no. 74, May 1926, p. 61, 1 fig. First installations of superchargers driven by exhaust-gas turbines are being made on two motor passenger ships, Preussen and Hansastadt Danzig, recently launched in Germany; they are equipped with two Vulcan-M.A.N. 4-cycle single-acting engines.

Types. A Comparison of Diesel Engines, M. Gercke. Motorship (Lond.), vol. 7, no. 79, Oct. 1926, pp. 250-252. Analysis of characteristics of single- and double-acting 4-cycle and 2-cycle Diesel engines.

DRILLING MACHINES

Piston. "Hole Hog" No. 19 Horizontal Duplex Piston-Drilling Machine. Am. Mach., vol. 65, no. 22, Nov. 25, 1926, p. 885, 1 fig. Built by Moline Tool Co., Moline, Ill., with four standard heads, and jig for drilling wrist-pin holes in automotive pistons.

Multiple. Multiple Drilling Operations on Engine Parts, W. F. Sandmann. Machy. (N.Y.), vol. 33, no. 2, Oct. 1926, pp. 115-117, 7 figs. Machines designed to meet specific drilling requirement, made by National Automatic Tool Co., Richmond, Ind.

DRYDOCKS

British Columbia. Caissons for the Canadian Government Drydock at Esquimalt, B.C. Engineering, vol. 122, no. 3174, Nov. 12, 1926, pp. 593-594, 14 figs, partly on supp. plates. Usable length of dock is 1,150 ft., width of entrance at coping level is 135 ft., and depth over sill at high tide is 40 ft.; it is closed and sectionalized by caissons floated into position; details of ship-type caissons built for this purpose.

DURALUMIN

Corrosion. Duralumin and Its Corrosion, W. Nelson. Aviation, vol. 16, no. 18, Nov. 1, 1926, pp. 738-741, 4 figs. Complicity of corrosion problem; factors governing corrosion; corroding mediums; effects of salt atmosphere and of fuel; contact and induced corrosion; corroding solutions.

PROPERTIES. Duralumin, L. Atchison. Flight (Aircraft Engr.), vol. 18, nos. 12, 17, 21, 25, 30, 39 and 43, Mar. 25, Apr. 29, May 27, June 24, July 29, Sept. 30 and Oct. 28, 1926, pp. 178a-178c, 260g-260i, 308g-308h, 362f-362h, 464a-464c, 636a-636c and 702d-702e. Reheating and heat-treating of duralumin. Apr. 19: Tests to determine mechanical properties. May 27: Process of working after quenching; heating prior to quenching; working of salt baths. June 24: Corrosion and its causes. July 29: Hot working of duralumin; preparation of forging. Sept. 30: Discontinuities in duralumin. Oct. 28: Machining of forgings and drop forgings, and extruded and hammered duralumin bars; duralumin tubes; welding.

DUST

EXPLOSIONS. Some Chemical and Engineering Aspects of Dust Explosion, D. J. Price. Chem. & Met. Eng., vol. 33, no. 10, Oct. 1926, pp. 599-601, 1 fig. Plant location and design, fineness of dust, relative humidity and dust removal have important bearing on origin and extent of explosions. (Abstract.) Paper read at Chemical Equipment and Process Engineering Exposition, Cleveland, O.

E

ECONOMIZERS

HIGH-SPEED. The Design of High-Speed Economizers, B. M. Thornton. Engineering, vol. 122, no. 3174, Nov. 12, 1926, pp. 592-593, 1 fig. Presents exact, and, in author's belief, novel method of economizer design.

EDUCATION, ENGINEERING

INVESTIGATION. Summary of the Fact-Gathering Stages of the Investigation of Engineering Education, H. P. Hammond. Eng. Education—Jl., vol. 17, no. 1, Sept. 1926, pp. 52-82, 1 fig. Summary of facts gathered during past two years by Society's Investigation; deals with organization, personnel, supplementary activities of engineering colleges, research, costs, curricula and degrees.

TEACHING PERSONNEL. Engineering Teaching Personnel. Eng. Education—Jl., vol. 17, no. 2, Oct. 1926, pp. 217-261, 7 figs. Study undertaken through statistical means as accurate conception as possible of certain aspects of status of engineering teachers in United States and Canada and upon basis of that information improvement of teaching staffs.

ELECTRIC CIRCUITS, A.C.

GRAPHICAL SOLUTIONS. Some Graphical Solutions of A.C. Circuits Founded Upon Non-Euclidian Geometry, F. W. Lee. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1078-1084, 20 figs. Develops graphical method for solution; certain characteristics of circuits are identified which greatly simplify these solutions.

ELECTRIC CONDUCTORS

ECONOMICAL SIZE. Determination of the Economical Size of Electrical Conductors, F. T. Stocking. Elec. News, vol. 35, no. 20, Oct. 15, 1926, pp. 27-29. Discusses formulas prepared for calculating economical cross-section for given load under various conditions of power cost and cost of materials.

UNBALANCED TENSIONS. Unbalanced Conductor Tensions, E. S. Healy and A. J. Wright. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1144-1150, 12 figs. Tests to show their effects in long-span transmission line.

ELECTRIC DISTRIBUTION SYSTEM

HEAVY A.C. Heavy A.C. Distribution, G. J. Newton. Elec. Light & Power, vol. 4, no. 11, Nov. 1926, pp. 21-26, 78, 80, 82, 84, 88, 90, 92 and 94, 10 figs. In author's belief, 3-phase, 4-wire system is most practical solution of economical and reliable distribution available at present time, particularly for underground systems in congested districts where heavy loads are encountered or anticipated.

ELECTRIC FURNACES

COMBUSTIBLE GASES, RECOVERY OF. Utilization of Electric-Furnace Gases (Sur le captage des gaz de fours électriques), P. Bunet. Revue Génerale de l'Electricité, vol. 20, no. 9, Aug. 28, 1926, pp. 315-321, 6 figs. Author maintains that CO produced as by-product at most electric furnaces operating on reduction principle should not be permitted to escape unused; it is not difficult to arrange cope of furnace in such a way as to catch these combustible gases and to utilize them as direct or motor fuel; manufacture of calcium carbide is taken as example and economies realized if developed gases are caught and use as set forth; similar example is given for electric steel furnace where 30 to 40 per cent of energy required by furnace can be regained from generators driven by gas motors, which operate from exhaust gases of furnace.

TOOL HARDENING. Lead-Bath Furnace Improves Tool Hardening, J. L. Faden. Elec. World, vol. 88, no. 20, Nov. 13, 1926, p. 1025, 1 fig. Installation of 23-kw. electric furnace for operation on 230-volt, single-phase service in tool room of general service buildings of Edison Electric Illuminating Co., Boston, Mass.

100,000-AMPERE. A 100,000-Ampere Electric Furnace. Elec. Rev., vol. 99, no. 2550, Oct. 8, 1926, pp. 597-598, 2 figs. Particulars of single-electrode furnace installed in France.

ELECTRIC GENERATORS

COMMUTATOR FLASHOVERS. Commutator Flashovers in Generators and Motors, J. H. Harvey. Elec. Jl., vol. 23, no. 11, Nov. 1926, pp. 583-585, 6 figs. One of most effective means of preventing flashover is to prevent short-circuit current from reaching high value; this is accomplished by inserting resistance in circuit at very inception of short-circuit by means of high-speed circuit-breaker.

WATER-WHEEL TYPE. Fire Protection of Water-Wheel Type Generators, J. A. Johnson and E. J. Burnham. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1121-1130, 20 figs. Describes system of fire protection which is designed to limit both fire and water damage to section of generator immediately adjacent to point of origin of fire; means for preventing and detecting fires in such generators.

ELECTRIC LOCOMOTIVES

FREIGHT. New York Central Electric Freight Locomotives, E. B. Katte. Ry. Age, vol. 81, no. 18, Oct. 30, 1926, pp. 845-848, 8 figs. Two-unit locomotive is designed to haul 3,000-ton train at 32 miles per hour. See Elec. Ry. Jl., vol. 68, no. 18, Oct. 30, 1926, pp. 796-801, 12 figs.

STORAGE-BATTERY. Unusual Type of Storage Battery Locomotive with Gas-Electric Auxiliary, W. D. Bearce. Gen. Elec. Rev., vol. 29, no. 11, Nov. 1926, pp. 762-764, 3 figs. New switching locomotive made at Erie, Pa., and shipped on its own wheels to Chicago, Ill., arranged for either storage-battery or gas-electric operation or both.

ELECTRIC METERS

SHUNTS. Meter Shunts for Heavy Direct Currents, F. A. Dahlgren. Elecn., vol. 97, no. 2526, Oct. 29, 1926, p. 499, 3 figs. Principles of current flow through bar or tube shunts are developed with regard to resultant voltage drop between mid-points of contact pieces, current being fed into and taken out from these contact pieces in different ways.

ELECTRIC MOTORS

MILL-TYPE. Preliminary Report of the Standardization Committee of the Association of Iron and Steel Electrical Engineers for Year 1926, A. C. Cummins. Iron & Steel Engr., vol. 3, no. 10, Oct. 1926, pp. 427-437, 14 figs. Standardized commutating-pole mill-type motor.

ELECTRIC MOTORS, A.C.

INDUCTION. The G.E.C. All-Watt Induction Motor. Mech. World, vol. 80, no. 2077, Oct. 22, 1926, p. 237, 4 figs. General Electric Co. has recently developed Witton "all-watt" induction motor.

INDUSTRIAL DRIVES. Selection of Motors for Industrial Power Drives, P. C. Jones. Indus. Engr., vol. 84, no. 10, Oct. 1926, pp. 449-455, 15 figs. Operating characteristics of more common types, with special emphasis on advantages of synchronous motors.

SQUIRREL-CAGE. Methods of Putting Windings on Squirrel-Cage Rotors, B. A. Briggs. Power, vol. 64, no. 17, Oct. 26, 1926, pp. 621-623, 8 figs. How end rings are connected to rotor bars by pressing them on, by welding processes and by casting them to bars.

WINDINGS. Construction of Squirrel-Cage Motor Windings, B. A. Briggs. Power, vol. 64, no. 21, Nov. 23, 1926, pp. 769-771, 9 figs. Among many types of windings used are those made of one piece of metal, those that comprise number of short-circuited coils and others that have laminated end rings; these are described and effects of type of slots and length of air gap on operation of machine.

ELECTRIC WELDING

SEAM. Electric Seam Welding Applied to Sheet-Metal Work, F. W. Curtis. Am. Mach., vol. 65, no. 21, Nov. 18, 1926, pp. 833-835, 8 figs. Principles of seam-welding machine and procedure to follow in welding different types of work; examples of welding operations; importance of cleaning; knurling rolls for sealing. See also description of machine in Iron Age, vol. 118, no. 21, Nov. 18, 1926, p. 413.

ELECTRIC WELDING, ARC

HYDROGEN. Welding with the Atomic Hydrogen Flame, R. A. Weinman. Am. Welding Soc.—Jl., vol. 5, no. 10, Oct. 1926, pp. 69-76, 14 figs. Results attained in research laboratory of General Electric Co. with this process indicate quite clearly that welds can be made by it which cannot be made by any other known means; however, apparatus is hardly out of laboratory stage, and requires further development to suit general commercial conditions.

ELECTRIC WELDING, RESISTANCE

SEAMS. Welding Tight Seams Quickly. Welding Engr., vol. 11, no. 10, Oct. 1926, pp. 55-56, 6 figs. Team work between resistance seam welder and spot welder speeds up production programme of electric dishwasher factory.

ELECTRIC WIRING

CALCULATION. Calculation of Wire and Conduit Sizes, M. Kushlan. Elec. World, vol. 88, no. 20, Nov. 13, 1926, pp. 1012-1015, 2 figs. Series of curves based on fundamental formulas offers short solution for checking feeder design or making preliminary estimates.

ELECTRICAL EQUIPMENT

PROTECTIVE DEVICES. Present Practices in Protection, E. C. Stone. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1098-1114, 5 figs. Annual report of Committee on Protective Devices; current limiting reactors; lightning arresters; Dufour cathode-ray oscillograph; klydonograph; oil circuit breaker tests; protective relays.

ELECTRICAL MACHINERY

HEAT TRANSFER. Surface Heat Transfer in Electric Machines with Forced Air Flow, G. E. Luke. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1070-1078, 16 figs. Additional information that will explain inconsistencies in past tests; rate of heat losses as influenced by duct length. Bibliography.

ELEVATORS

CONTROLLERS. Operation of Semi-Magnet Type Elevator Controllers, C. A. Armstrong. Power, vol. 64, no. 19, Nov. 9, 1926, pp. 693-696, 6 figs. Explains difference between semi-magnet and full-magnet types and operation and circuits of three semi-magnet type controllers.

EMPLOYEES

RATING. The Essentials of a Plan for Rating Employees, H. Feldman. Indus. Mgmt. (N. Y.), vol. 72, no. 5, Nov. 1926, pp. 295-300, 4 figs. Defects of current traditional method compared with systematic rating plans; scientific rating sheet; definite qualities to be rated; determining numeral equivalents for qualities and their gradations; use of graphic rating scale.

EMPLOYMENT MANAGEMENT

PERSONNEL MANAGERS. An Interest Test for Personnel Managers, E. K. Strong, Jr. Personnel Research—Jl., vol. 5. no. 5, Sept. 1926, pp. 194-203, 3 figs. Vocational selection; compares interests of personnel managers with those of large number of men in various other occupations and uses these comparisons to devise scoring method which discovers how well person's interests conform to those of personnel managers.

ENERGY

FUTURE SOURCES OF. Our Future Sources of Energy, H. L. Doherty. Indus. & Eng. Chem., vol. 18, no. 10, Oct. 1926, pp. 1062-1064. Efficiency of energy utilization; possibilities for conserving energy; science's limitations to progress.

ENGINEERS

GRADUATES AND NON-GRADUATES. Engineering Graduates and Non-Graduate Former Students. Eng. Education—Jl., vol. 17, no. 2, Oct. 1926, pp. 172-216, 10 figs. Study undertaken to obtain information regarding careers of engineering graduates and relationship of their work to courses pursued in college; to determine means through which they obtain first positions; information regarding their early experiences and adjustments to industrial life; and to obtain their opinions regarding various phases of engineering education.

TRAINING. How Should an Engineer be Trained? T. Morison. North-East Coast Instn. Engrs. & Shipbldrs.—Advance Paper, Oct. 29, 1926, pp. 17-24. Three stages in training of engineer, (1) workshop experience, (2) scientific education in university or technical college, (3) practical training under commercial conditions; training of exceptional apprentice.

EXPLOSIONS

GASEOUS. Explosive Reactions Considered Generally, W. E. Garner. Faraday Soc.—Trans., vol. 22, no. 69, Oct. 1926, pp. 253-266, 3 figs. Factors operating in gaseous explosions; temperatures of combustion and specific heat of gases; speed of chemical reaction; ignition temperatures and period of pre-flame; propagation of flame; uniform movement of flame; limits of inflammability; detonation wave; chemical kinetics and catalysis in gaseous explosions. Bibliography.

Radiation in Gaseous Explosions, W. T. David. Faraday Soc.—Trans., vol. 22, no. 69, Oct. 1926, pp. 273-280, 6 figs. Experiments made upon emission of radiation from exploded gaseous mixtures contained in closed vessel, which throw light upon nature and origin of emitted radiation; and experiments showing effect of introducing infra-red radiation into inflammable gaseous mixtures containing nitrogen upon their rate of combustion.

F

FANS

Efficiency. The Efficiency of a Fan, J. W. Whitaker. Colliery Guardian, vol. 132, nos. 3434 and 3435, Oct. 22 and 29, 1926, pp. 883-884 and 938-939, 5 figs.

FATIGUE

Industrial. Monotony in Repetitive Operations, L. M. Gilbreth. Iron Age, vol. 118, no. 20, Nov. 11, 1926, p. 1344. Author claims that unnecessary fatigue in routine productive jobs may be avoided by scientific study of human elements involved.

FILTRATION PLANTS

Detroit, Mich. Eighteen Months' Operation of the Detroit Filtration Plant, W. M. Wallace. Am. Water Works Assn.—Jl., vol. 16, no. 4, Oct. 1926, pp. 465-473. In construction of plant there were no unusual departures from general design of other plants, exclusive of mixing chamber, which is considerably smaller in proportion to capacity of plant than those provided in most recent filter installations.

FIREDAMP

Explosions. Firedamp Explosions: The Projection of Flame, M. J. Burgess. Safety in Mines Research Board—Paper, no. 27, 1926, 14 pp., 4 figs. Results of laboratory experiments in which influence of different factors had been studied systematically; distance of projection of flame from firedamp explosions has been determined under different conditions as regards length of column of explosive mixture, size of aperture between tube containing explosive mixture and that containing atmosphere into which flames were projected, and character of that atmosphere; shows that projection of flame into air in unconstructed tube is between five and six times length of original column of explosive mixture; projection of flame into CO_2 is shorter than into air and is about three times length of original column of explosive mixture.

FLOW METERS

Electrically-Operated. An Electrically-Operated Flow Meter. Engineer, vol. 142, no. 3695, Nov. 5, 1926, pp. 504-505, 4 figs. Meter for indicating, recording or integrating rate of flow of steam, water, air, gas or other fluid, made by Brown Instrument Co., Philadelphia.

FLOW OF AIR

Static-Pressure Measurement. Measurement of Static Pressure, C. J. Fechheimer. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 10 pp., 8 figs. Describes new instrument for measuring static pressures in air-flow determinations.

FLOW OF FLUIDS

Pipes. Fluid Flow in Pipes of Annular Cross-Section, D. H. Atherton. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1112-1114, 8 figs. Investigations to determine actual values of friction coefficients for flow of air, oil and water through pipes of annular cross-section.

FLOW OF LIQUIDS

Capillaries. The Flow of Liquids Through Capillaries, N. E. Dorsey. Phys. Rev., vol. 28, no. 4, Oct. 1926, pp. 833-845, 1 fig. Develops simple theory of flow of liquid from reservoir, through capillary into second reservoir; conclusions from it are shown to accord with observations of Bond and Poiseuille, and with qualitative study of flow by means of coloured streams.

Orifice. Orifice Flow as Affected by Viscosity and Capillarity, H. W. Swift. Lond., Edinburgh and Dublin Philosophical Mag., vol. 2, no. 10, Oct. 1926, pp. 852-875, 6 figs. Criteria governing discharge; ideal liquid; effect of surface tension; and of variations in head; effect of viscosity.

FLOW OF WATER

Measurement. Present State of Measuring Flow of Water (Cenni sullo stato attuale della tecnica delle misure di portata), A. Melli. Annali dei Lavori Pubblici, vol. 64, no. 7, July 1926, pp. 580-612, 21 figs. Describes new types of hydrometric propellers, measuring flow in open channels by means of torchometers, weirs, salt, or chemicals, etc.; measuring flow in pressure conduits, distribution of velocity in cross-section, venturi meters, etc.

Rotating Cylinder, Behind. Experiments on the Flow Behind a Rotating Cylinder in the Water Channel, E. F. Relf and T. Lavender. Aeronautical Research Committee—Reports and Memoranda, no. 1009, May 1925, 2 pp., 11 figs. Observations on small cylinder in water channel which should prove useful as general indication of nature of flow to be expected at various speeds of rotation; photographs show clearly development of increasing circulation as rotational speed of cylinder increases and also shows that amount of eddying behind cylinder decreases as cylinder rotates more rapidly, thus indicating reason for reduction of drag observed by various experimenters.

FLUE-GAS ANALYSIS

CO_2 and CO Recorders. The Control of Flue Gases by Means of Carbon Dioxide Recorders, J. Grant. Indus. Chem., vol. 2, no. 21, Oct. 1926, pp. 433-436, 5 figs. Instruments which measure chemical composition of flue gases and changes in physical property of flue gases.

FLUE GASES

Sampling. Notes on the Sampling of Boiler-Flue Gases, C. G. Thatcher. Power, vol. 64, no. 21, Nov. 23, 1926, pp. 774-777, 9 figs. To find out actual conditions for several standard types of boilers, author has carried on extensive practical investigations; results of which are presented in form that will be helpful to engineers confronted with this problem.

FLYING BOATS

Rohrbach. Wing Loading and World's Records. Flight, vol. 18, no. 42, Oct. 21, 1926, pp. 686-687, 5 figs.

FLYWHEELS

Balancing. Balacing Flywheels on a Ball, M. R. Wells. Machy. (N.Y.), vol. 33, no. 2, Oct. 1926, pp. 126-128, 5 figs. Author first made a simple adapter fitted with pointer, by means of which fan assembly could be hung on sharp pointed support, and then redesigned it so that load was supported by steel ball, resting on hardened and flat end of central post; method of checking balance; analysis of balancing principle. See also Machy. (Lond.), vol. 29, no. 732, Oct. 21, 1926, pp. 73-75, 5 figs.

Moments of Inertia. The Estimation of Moments on Inertia of Flywheels, P. F. Poster. Machy. (Lond.), vol. 29, no. 733, Oct. 28, 1926, pp. 105-107, 7 figs. Investigation of application of direct and indirect processes.

FORGING

Upset Process. Forging by the Upset Process, J. C. Kielman. Am. Soc. Steel Treating—Trans., vol. 10, no. 4, Oct. 1926, pp. 599-614, 11 figs. Deals with forgings used in manufacture of ball bearings.

FOUNDRIES

Progress. Fifty Years of Foundry Progress, S. G. Smith. Foundry Trade Jl., vol. 34, no. 531, Oct. 21, 1926, pp. 349-352. Survey of author's experience touches upon phases of work that have made some advancement in recent years.

Steel. The Steel Foundry, H. M. Boylston. Fuels & Furnaces, vol. 4, no. 10, Oct. 1926, pp. 1179-1186, 4 figs. Discussion of moulding, moulding sands, moulding machines and processes used in steel foundry; specifications; physical properties, defects of steel castings and their remedy.

FOUNDRY EQUIPMENT

Flasks. Standards for Flasks Needed, H. M. Ramp. Iron Age, vol. 118, no. 20, Nov. 11, 1926, pp. 1335-1337, 8 figs. Standard dimensions recommended for cast-iron and cast-steel flasks with design covering pins, pin lugs, handles, flanges, trunnions and bars.

Sand-Dressing Plant. Renovating Foundry Sand. Engineer, vol. 142, no. 3692, Oct. 15, 1926, p. 426, 3 figs. French sand-preparing plant which is intended for reconditioning green sand used in foundry and avoiding expense so frequently incurred in scrapping sand which has been used in moulds once and replacing it by new sand.

FRICTION

Elastic Range. The Elastic Range of Friction, J. S. Rankin. Lond., Edinburgh and Dublin Philosophical Mag., vol. 2, no. 10, Oct. 1926, pp. 805-816, 6 figs. Reference is made to paper on molecular contact by J. S. Stevens, where it is shown, by interferometer method, that in ordinary experiment for finding coefficients of friction, elastic strains are produced before slipping occurs; describes apparatus for measuring this elastic range of friction by using Whiddington's oscillating valve ultramicrometer method; results are given for steel resting on cast iron, and elastic range and yield point for friction are clearly shown.

FUELS

Coal. *See Coal; Pulverized Coal.*

Oil. *See Oil Fuel.*

Pulverized Coal. *See Pulverized Coal.*

FURNACES, ANNEALING

Waste-Heat Recovery. Waste Gases from Annealing Furnaces, C. H. S. Tupholme. Iron & Coal Trades Rev., vol. 113, no. 3060, Oct. 22, 1926, p. 617, 2 figs. Waste-heat boiler was installed by Sulzer Bros. at works of Swiss Trading Co., Neuhausen, for recovery of heat and its use for raising high-pressure steam.

FURNACES, INDUSTRIAL

Oil-Burning. Piping Systems for Oil-Burning Furnaces, C. C. Hermann. Machy. (N.Y.), vol. 33, no. 3, Nov. 1926, pp. 201-203, 4 figs. Analyzing average complaint of given industry using present-day oils, it is generally found that entire trouble is due to lack of recirculation of oil; shows how objectionable features of dead-end system have been eliminated by utilization of recirculation of oil.

G

GAUGES

Checking. Centralized Gauge Checking Department, G. C. Reilley. Machy. (N.Y.), vol. 33, no. 3, Nov. 1926, pp. 172-175, 8 figs. System employed to insure accurate gauges in large plant which uses more than 20,000 pin gauges alone.

GAS ENGINES

Combustion in. Combustion in Gas Engines, W. T. David. Faraday Soc.—Trans., vol. 22, no. 69, Oct. 1926, pp. 341-351, 6 figs. Extent to which incomplete combustion affects pressures developed in gas engines; factors influencing rate of combustion.

Piston Friction. The Pressure Between the Piston and Cylinder Wall in the Gas and Petrol Engine, S. J. Ellis. World Power, vol. 6, no. 35, Nov. 1926, pp. 259-261, 2 figs. Discusses two particular cases, that of gas engine running at 260 r.p.m. with slipper piston and connecting-rod crank ratio of 5 to 1, and gasoline engine running at 2,200 r.p.m. with connecting-rod crank ratio of 4 to 1.

GAS HOLDERS

High-Pressure. High-Pressure Gas Holders, G. T. Horton. West. Soc. Engrs.—Jl., vol. 31, no. 9, Sept. 1926, pp. 367-372, 7 figs. Analyzes comparative cost of erecting number of comparatively small storage tanks for gas under pressure with one large tank, and also compares cost of spherical holders for high-pressure storage with known types of low-pressure holders.

GASES

Temperature-Entropy Diagram. Temperature-Entropy Diagram for Air and the Diatomic Gases O_2, N_2 and CO, H. A. Everett. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1329-1332, 2 figs. Diagram has been prepared for group of gases for temperature range from 500 to 5,500 deg. Fahr. abs.; this permits ready solution of problems dealing with these gases where high temperatures are involved without necessity of employing involved or indirect mathematical solutions that take account of variability of specific heats; examples of its use in solution of problems in adiabatic compression and internal-combustion-engine ideal cycles.

GEARS

Pin. Pin Gearing, L. E. King. Machy. (N.Y.), vol. 33, nos. 1 and 2, Sept. and Oct. 1926, pp. 35-37 and 111-114, 5 figs. Sept.: Relation of involute and cycloidal gearing to pin gearing as applied in watch and clock mechanisms. Oct.: Methods of laying out; advantages for watch and clock mechanisms.

Pinion Cutting. Pinions Cut from Enlarged Blanks, R. S. Condon. Machy. (N.Y.), vol. 33, no. 3, Nov. 1926, pp. 192-195, 5 figs. Increased strength of enlarged pinions and data for establishing blank sizes; question of tooth interference; effect on base-circle radius; maximum amount pinion blank can be made oversize; cutting oversize gears.

Spur. Proposed Standard for Spur-Gear Tooth Form. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1157-1158, 5 figs. Proposed standard represents present practice for 14½ deg. full-depth.

Teeth, Strength of. The Strength of Gear Teeth, S. Timoshenko and R. V. Baud. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1105-1109, 11 figs. Discusses stresses in and deflections of gear teeth; by using photoelastic method stress concentration at tooth root has been studied and factors thereof established for various radii of fillet.

Tooth-Caliper Settings. A Quick Method for Obtaining Gear Tooth Caliper Settings, H. Walker. Machy. (Lond.), vol. 29, no. 730, Oct. 7, 1926, p. 17, 1 fig.

TOOTH FORM. Helical and Spur Gearing. Elec. Traction, vol. 2, no. 10, Oct. 1926, p. 538. Abstract of report of committee of American Elec. Ry. Assn. Consideration of tooth form and limit of wear gauges recommends that discard gauges for helical gearing and for spur gearing be approved as recommended standards.

GLUE

ELECTRIC HEATING. Heating Glue Electrically. Nat. Elec. Light Assn.—Report, no. 256-82, Aug. 1926, 3 pp., 2 figs. Notes on soaking, melting and testing glues; miscellaneous suggestions; advantages of electrically-heated glue pot.

GOLD MINING

UNDERGROUND. Underground Operations at the Dome Mines, J. B. Phillips. Can. Inst. of Min. & Met.—Bul., no. 174, Oct. 1926, pp. 1070-1094, 12 figs. Mine is entered by central vertical shaft strongly timbered and containing two compartments; one for passenger cage, other for large skips bringing ore to surface; ore between levels is removed by stoping; narrow-gauge electric railway system is operated underground; with small storage-battery locomotive on each important level; ventilation underground is secured by natural air currents in shaft; drilling and cutting; shaft-sinking; explosives used in blast; large per cent of ore, particularly in presence of much copper and other impurities is extracted by amalgamation; rest is treated by cyanidation.

GYPSUM

MINING AND REFINING. Modern Methods and Processes of Mining and Refining Gypsum, A. W. Tyler. Rock Products, vol. 29, no. 22, Oct. 30, 1926, pp. 52-57, 19 figs. Automatic partition tile machine and their products.

H

HEAT TRANSMISSION

CONDENSERS AND WATER HEATERS. Heat Transmission from Condensing Steam to Water in Surface Condensers and Feedwater Heaters, W. H. McAdams, T. K. Sherwood and R. L. Turner. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 28 pp., 17 figs.

MEASUREMENT. Methods That Have Been and Are Being Used for Measuring Heat Transmission, F. G. Hechler. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1337-1343, 5 figs. Review of more important methods that have been used for measuring heat transmission for building and insulating materials, and discussion of their sources of error and probable accuracy. Bibliography.

MOVING AIR TO TUBES. Heat Transfer from Flowing Air to Tubes and Tube Nests, H. Reiher. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1155-1156. Investigation deals with heat transfer when direction of flow of air is normal to axis of tubes and, specifically with determination of coefficient of heat transfer between hot air and tubes and tube nests through which water is flowing, under various arrangements of artificially established convection. (Abstract.) Translated from Forschungsarbeiten, no. 269, 1925.

REFRACTORIES. Status of Heat-Transmission Data and Knowledge in the Refractory Field, P. Nicholls. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1307-1311. Requirements of practical engineering; data available for engineering problems and review of literature therefor; conclusions from analyses. Bibliography.

HEATING AND VENTILATION

OFFICE BUILDINGS. Unique Cooling and Heating System for Office Building, W. E. Kugemann, Jr. Heat. & Vent. Mag., vol. 23, no. 10, Oct. 1926, pp. 67-72, 10 figs. Details of American Radiator Co. building installation, designed by Dr. Brabbee and looked upon as experiment, on practical scale, with this type of equipment.

HEATING, STEAM

CENTRAL. World's Largest Boilers at Beacon Street Heating Plant, J. H. Walker. Power, vol. 64, no. 21, Nov. 23, 1926, pp. 762-765, 5 figs. This station will ultimately contain 12 great boilers, having nearly an acre of steam-making surface and exceeding in size any boiler heretofore constructed.

HIGHWAYS

WORLD PRACTICES. Road Congress Reviews World Highway Practices, T. H. MacDonald. Eng. News-Rec., vol. 97, no. 18, Oct. 28, 1926, pp. 700-701. International meeting in Milan, Italy, featured by papers on highway design and construction; lack of papers on highway economics.

HYDRAULIC TURBINES

FRICTION BRAKES. Friction Brakes Used on Hydraulic Turbines. Power Plant Eng., vol. 30, no. 21, Nov. 1, 1926, p. 1153, 1 fig. Friction brakes for both vertical and horizontal waterwheel generators are being built in Germany and installed in several hydro-electric plants. Translated from Zeit. des Vereines deutscher Ingenieure.

HIGH SPECIFIC SPEED. European High Specific Speed Hydraulic Turbines, M. P. O'Brien and M. J. Zucrow. Power Plant Eng., vol. 20, no. 21, Nov. 1, 1926, pp. 1166-1170, 8 figs. Several types of propeller runners have been developed by European manufacturers to meet low-head conditions.

WATER VELOCITIES IN. Water Velocities in Hydraulic Turbine Plants, J. S. Carpenter. Power Plant Eng., vol. 30, no. 22, Nov. 15, 1926, pp. 1210-1211. In designing new plants and rebuilding old ones, water velocities affect pipe lines, sizes, scroll cases and draft tubes, and speed regulation.

HYDRO-ELECTRIC PLANTS

CALIFORNIA. Another Low-Head Plant for California—Exchequer Utilizes Irrigation Waters, A. A. Blakesley. Indus. & Eng. Chem., vol. 18, no. 10, Oct. 1926, pp. 232-237, 11 figs.

ONTARIO. Norman Dam Hydro Power Development, S. T. McCavour. Can. Engr., vol. 51, no. 17, Oct. 26, 1926, pp. 583-585, 6 figs.

RACK CLEANING. Improved Rack-Cleaning Methods in Rheinfelden Power Plant Verbesserte Rechenreinigung in Kraftwerk Rheinfelden), R. Haas and S. Bitterli. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 45, Nov. 6, 1926, pp. 1483-1485, 9 figs. Details of new equipment which save nine-tenths of labour required heretofore and eliminates head losses amounting to 2 million kw.-hr.

I

ICE PLANTS

DIESEL ENGINES IN. Cutting Power Costs in Ice and Refrigerating Plants, H. R. Bacon. Ice & Refrigeration, vol. 71, no. 4, Oct. 1926, pp. 215-218, 6 figs. Improvements in Diesel engines show decided economies; fuel consumption in terms of plant capacity; lubricating-oil consumption; estimate of what Diesel power will cost to give dependable service over long period.

INDUSTRIAL MANAGEMENT

ADMINISTRATION POLICIES. Top Control, J. H. Williams. Taylor Soc.—Bul., vol. 11, no. 4, Oct. 1926, pp. 199-206. Ways and means of making managerial policies effective.

BIBLIOGRAPHY. Nucleus of a Management Library. Taylor Soc.—Bul., vol. 11, no. 4, Oct. 1926, pp. 224-230. With emphasis on scientific management.

LAWS. Laws of Manufacturing Management, L. P. Alford. Am. Soc. Mech. Engrs. —Advance Paper, for mtg. Dec. 6-9, 1926, 28 pp. Discusses laws of management in general; states that principles of management have been discussed but not generally accepted; investigation is limited to manufacturing management; sets forth 43 laws of management with supporting citations.

INDUSTRIAL PLANTS

POWER COSTS. The Highways and Byways of Power Cost, F. M. Gibson. Indus. Mgmt. (N.Y.), vol. 72, no. 5, Nov. 1926, pp. 273-278, 9 figs. Author discusses factors to be considered in seeking to keep power costs at minimum.

INDUSTRIAL RELATIONS

EMPLOYERS' RESPONSIBILITIES. The Employer—His Responsibilities, C. Piez. Machy. (N.Y.), vol. 33, no. 3, Nov. 1926, pp. 196-197. Primarily employer's responsibility to his workers consists in providing them with steady work under sanitary conditions, at best possible wages; equitable distribution of returns of industry; discusses profitability of average business.

INSULATION, HEAT

THERMAL CONDUCTIVITIES. Determination of the Thermal Conductivities of Insulation for Temperatures up to 1,000 Deg. Fahr. on Other Than Flat Surfaces, R. H. Heilman. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1297-1306, 16 figs. Report to National Research Council reviewing past work, deducing defects in apparatus hitherto used and results obtained, and suggesting what should be done to obtain accurate and reliable apparatus and test results; apparatus for determination of thermal conductivity of pipe coverings; apparatus used in testing heat-insulating cements. Bibliography.

Nomography for Coefficient of Thermal Conductivity, M. T. Zarotschenzeff. Ice & Refrigeration, vol. 71, no. 4. Oct. 1926, pp. 246-248, 2 figs.

INTEGRAPHS

DESIGN. A Simple Integraph, A. A. Robb. Lond., Edinburgh and Dublin Philosophical Mag., vol. 2, no. 10, Oct. 1926, pp. 778-782, 2 figs. Describes exceedingly simple integraph; small drawing board is mounted on three supports forming sort of little table; one of these supports being rounded knife edge or small sharp-edged wheel, and others being smooth rounded studs which can move freely in any direction over flat surface of paper.

INTERNAL-COMBUSTION ENGINES

DETONATION. The Effect of Metallic Sols in Delaying Detonation in Internal-Combustion Engines, C. J. Sims and E. W. J. Mardles. Faraday Soc.—Trans., vol. 22, no. 69, Oct. 1926, pp. 363-370.

INDICATOR-CARD ANALYSIS. The Tangent Method of Analysis for Indicator Cards of Internal-Combustion Engines, P. H. Schweitzer. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1263-1274, 37 figs.

See also Airplane Engines; Diesel Engines; Oil Engines.

IRON ALLOYS

IRON-NICKEL. An Investigation of the Physical Properties of Some Nickel-Iron Alloys of the Invar Group, E. A. Blomqvist. Rensselaer Polytechnic Inst.—Eng. & Science Series, no. 13, June 3, 1926, 14 pp., 8 figs. Investigation covers study of two groups of iron-nickel alloys, first containing 35.5 per cent of nickel and second 38 per cent of nickel with varying additions of manganese and magnesium.

IRON ORE

FORMS OF. Nature Studies—Iron Ores, R. H. Danzinger. Blast Furnace & Steel Plant, vol. 14, no. 11, Nov. 1926, p. 465, 1 fig. Definitions of hematite, specularite, magnetite, limonite, turgite, goethite and siderite.

J

JAPANNING

BAKED FINISHES. Rapid Evaluation of Baked Japan Finishes, E. M. Honan and R. E. Waterman. Indus. & Eng. Chem., vol. 18, no. 10, Oct. 1926, pp. 1066-1068, 1 fig. Service life of japan film baked on metal can be evaluated by determining rate of decomposition of film when it is placed in 8.5 per cent phenol-water solution.

L

LABOUR TURNOVER

ANALYSIS. Mechanical Aids in Analyzing Labour Turnover, R. E. Motley. Indus. Mgmt. (N.Y.), vol. 72, no. 5, Nov. 1926, pp. 323-328, 12 figs. Use of various forms necessary for obtaining and maintaining adequate records for each employee, and procedure followed in securing vital facts relative to man-power activities at plant of Atlantic Refining Co.

LIGHTING

ELECTRIC. Status of Electric Lighting in 1926, P. S. Millar. Am. Inst. Elec. Engrs. —Jl., vol. 45, no. 11, Nov. 1926, pp. 1115-1120, 3 figs. Report of Committee on Production and Application of Light.

POWER HOUSE AND SUBSTATIONS. Power House and Substation Illumination, M. M. Samuels. Elec. Light & Power, vol. 4, no. 11, Nov. 1926, pp. 27-29, 10 figs. Co-operation of power plant designer and illuminating engineer is essential for satisfactory lighting design; outdoor substation offers one of most difficult problems.

LOCOMOTIVE BOILERS

PITTING. Means of Preventing Boiler Pitting, C. H. Koyl. Ry. & Locomotive Eng., vol. 39, no. 10, Oct. 1926, pp. 278-279. Author shows that it is easier to exclude oxygen from locomotive boiler than from stationary boiler or any closed water system.

LOCOMOTIVES

DESIGN. The Present and Future of Locomotive Design, A. G. Trumbull. Ry. & Locomotive Eng., vol. 39, no. 10, Oct. 1926, pp. 284-287, 1 fig.

DEVELOPMENT. Locomotive Developments of To-day. Ry. Rev., vol. 79, no. 15, Oct. 9, 1926. Contains abstracts of following papers: Present and Future of Locomotive Design, A. G. Trumbull, pp. 549-552, 5 figs.; Improving Steam Locomotive, J. Muhlfeld, pp. 553-555, 1 fig.; Designer Must Have Courage, W. L. Bean, pp. 555-556, 2 figs.

ELECTRIC. *See Electric Locomotives.*

HIGH-PRESSURE. The Use of High Steam Pressure in Locomotives, E. C. Schmidt and J. M. Snodgrass. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1195-1202, 12 figs. Summary of advantages of using high steam pressures in reciprocating locomotives, and review of more notable applications of steam pressures of 240 lb. per sq. in. or higher.

INTERNAL-COMBUSTION. Internal-Combustion Locomotive and Passenger Car for British Guiana. Ry. Gaz., vol. 45, no. 14, Oct. 1, 1926, pp. 395-396, 4 figs. Details of 80-hp. locomotive and passenger car supplied by J. Fowler & Co. (Leeds) for use in transporting natives on sugar plantations.

Oil-Electric. Application of the Oil-Electric Locomotive to Railroad Transportation, W. L. Garrison. South. & Southwest. Ry. Club, vol. 18, no. 11, Sept. 1926, pp. 6-25 and (discussion) 25-42, 7 figs.

Power Rating in Tractive Force. Preliminary Power Rating and Tractive Force of Modern Locomotives, R. Eksergian. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1095-1103, 8 figs.

LUBRICANTS

Storage and Handling. Storage, Handling and Protection of Lubricants, A. F. Brewer. Elec. Ry. Jl., vol. 68, no. 17, Oct. 23, 1926, pp. 761-764, 6 figs. Central oil house desirable where large volume of lubricants is handled; proper construction makes danger of fire almost impossible; location near railroad siding or street reduces handling.

LUBRICATION

Steel-Mill Machinery. New Methods of Lubricating Steel-Mill Machinery, C. H. Bromley. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1344-1346, 2 figs. Requirements in lubricating oils; characteristics of lubricants suitable for gears and journals; gravity- and pressure-type lubricating systems; rates at which oil should be supplied, etc.

M

MACHINE TOOLS

T-Slot Standardization. T-Slots, Their Bolts, Nuts and Cutters. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1158-1159, 3 figs. Reason for standardization; existing standards and tendencies; A.E.S.C. Sectional Committee recommends width of throat greater than nominal diameter of bolt; inserted and reversible tongues and tongue seats to provide during transitional period for interchange of attachments fitted to T-slots having throat in some cases equal to and in some cases wider than nominal size of T-bolt.

MALLEABLE IRON

Black-Heart. The Embrittlement of Black-Heart Malleable Iron Resulting from Heating Overstrained Material, R. D. Allen. Am. Soc. Steel Treating—Trans., vol. 10, no. 4, Oct. 1926, pp. 630-637, 6 figs.

MATERIALS HANDLING

Economy in. Industry's Annual Tax for Materials Handling and Suggestions for Its Elimination, H. V. Coes. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp 1253-1256, 5 figs. How national materials-handling bill can be reduced a billion dollars a year by utilization of equipment now available, relocation of stock rooms, and proper co-ordination of production with equipment for moving materials. See also Mfg. Industries, vol. 12, no. 5, Nov. 1926, pp. 359-361, 4 figs.

METALLOGRAPHY

Non-Ferrous. Non-Ferrous Metallography, J. S. G. Primrose. Foundry Trade Jl., vol. 33, nos. 513 and 514, June 17 and 24, 1926, pp. 453-456 and 486-490, 26 figs. Results of experience in research into new properties, pathological investigation of failures and examination to ensure compliance with rigid specifications.

METALS

Corrosion Fatigue. Corrosion Fatigue, A. P. Hague. Metallurgist (Supp. to Engineer, vol. 142, no. 3694), Oct. 29, 1926, pp. 152-154, 9 figs. As result of investigations carried out in Cammell Laird research laboratories, it would appear that corrosion fatigue is responsible for many cases of failure which in past have been labelled mysterious; deals with relationship of corrosion fatigue to failure of street-car and railway axles; there is reason to believe that pitting in many cases commences at minute non-metallic inclusions in steel.

Fatigue. The Mechanism of the Fatigue Failure of Metals, H. F. Moore. Franklin Inst.—Jl., vol. 202, no. 5, Nov. 1926, pp. 547-568, 13 figs. Demonstrates what happens when metal fractures under repeated stress.

Latent Heat of Fusion. The Latent Heat of Fusion of Some Metals, J. H. Awbery and E. Griffiths. Phys. Soc. of Lond.—Proc., vol. 38, Aug. 15, 1926, pp. 378-398, 4 figs. Latent heats of number of commoner metals have been measured by determining total heat of liquid and solid from series of initial high temperatures; results for latent heat for aluminum, antimony, bismuth, lead, magnesium, tin and zinc; values for specific heats up to melting point, obtained by differentiation of temperature total heat curves.

Local Stresses. Local Stresses. Metallurgist (Supp. to Engineer, vol. 142, no. 3694), Oct. 29, 1926, pp. 145-146. Discusses cases in which severe local stressing may occur, such as sharp corners, notches of any kind, and jointing of material.

Melting and Mixing. Melting and Mixing. Metallurgist (Supp. to Engineer, vol. 142, no. 3694), Oct. 29, 1926, pp. 146-147. Discusses question of need for repeated melting of certain alloys if satisfactory castings are to be obtained.

Nitric Acid, Resistance to. Resistance of Metals to Nitric Acid, J. G. Thompson. Chem. & Met. Eng., vol. 33, no. 10, Oct. 1926, pp. 614-616. Studies on aluminum and its alloys, high-silicon and high-chromium steels, metallic chromium and chromium-nickel steels.

MILLING CUTTERS

Theory. Theory of Milling Cutters, N. N. Sawin. Mech. Eng., vol. 48, no. 11a, Mid-Nov, 1926, pp. 1203-1209, 7 figs. Presents theory which, it is believed, will provide basis for discussion; attempt is made to find theoretical formulas for calculating strength of mills and to determine their work.

MILLING MACHINES

Cam. Hydraulically-Loaded Cam Milling Machine. Engineer, vol. 142, no. 3691, Oct. 8, 1926, p. 388, 3 figs. Heavy-duty semi-automatic machine designed by Swedish concern.

Knee-Type. Heavy Hogging Cuts on Knee-Type Millers, H. Rowland. Can. Machy., vol. 36, no. 16, Oct. 14, 1926, pp. 13-15, 5 figs. Illustrates wide use of knee- and column-type machines for heavy jobs, specially in manufacture of electrical equipment.

MINE HOISTING

Equipment. Handy Hoisting and Hauling for Mines. Min. Congress Jl., vol. 12, no. 11, Nov. 1926, pp. 808-810 and 832, 7 figs. Many applications of these hoists under widely varying mining conditions; also used for unloading box cars loaded with concentrates; adaptability limited only by ingenuity of operator.

MINE LOCOMOTIVES

Storage-Battery. The Design of Storage-Battery Locomotives for Use in Coal Mines, L. Miller. Instn. of Elec. Engrs.—Jl., vol. 64, no. 358, Oct. 1926, pp. 1004-1010, 1 fig. Considerations which affect design of battery locomotive for use in mines; results of tests designed to compare coefficient of adhesion obtained with specially-prepared wheels and standard wheels on rails prepared to represent conditions met with in practice; methods of obtaining flame-proof enclosure of electrical apparatus; cost of running battery locomotive.

MINE TIMBERING

Preservation. The Preservation of Mine Timbers, G. Booth. Can. Inst. of Min. & Met.—Bul., no. 174, Oct. 1926, pp. 1108-1112. Agencies destructive to mine timbers; methods of increasing durability.

Preservative Treatment. Preservative Treatment of Mine Timbers at Primero Mine, F. T. Baker. Modern Min., vol. 3, no. 10, Oct. 1926, pp. 347-349. Methods and equipment employed at mines near Trinidad, Colo.

Standardization. Standardization of Mine Timbers is Needed, A. F. Brosky. Coal Age, vol. 30, no. 16, Oct. 14, 1926, pp. 531-533, 5 figs. Points out that present specifications cause much waste; mines with like conditions might well agree on standards; preservative treatment accorded mine timbers before installation will aid standardization.

MINES

Compressed Air. Compressed Air in Cool Mines, M. Picard. Can. Inst. Min. & Met.—Bul., no. 175, Nov. 1926, pp. 1167-1170. In author's opinion, for low-pressure work, low-pressure air should be generated in compressor installed underground adjacent to work, and that jacket-water of compressor should be utilized for reheating purposes; describes such system of compressed air distribution, designed especially for service in cool mines.

MOTION STUDY

Motion-Time Analysis. Motion-Time Analysis—A New Step in Operation-Study and Rate-Setting, L. P. Alford. Mfg. Industries, vol. 12, no. 5, Nov. 1926, pp. 341-344, 5 figs.

MOTOR-BUS TRANSPORTATION

562-Mile System. 562-Mile Transportation System. Bus Transportation, vol. 5, no. 10, Oct. 1926, pp. 542-544, 6 figs. Co-ordination of both physical and financial aspects of rail and bus operation has been successfully accomplished by Sioux Falls Traction System, South Dakota.

Railway Operation. Motor Bus Operations by Railways, K. L. McKee. Aera, vol. 16, no. 4, Nov. 1926, pp. 583-590, 1 fig. Analysis of statistics reveals only slight substitution of motor vehicle for electric railway service; trend toward larger buses and somewhat higher fares; most companies carry standees.

MUNICIPAL ENGINEERING

Problems and Practice. Municipal Engineering Problems and Practice. Eng. News-Rec., vol. 97, no. 21, Nov. 18, 1926, pp. 830-832. Review of papers and committee reports before Am. Soc. for Mun. Improvements on paving, city planning, finance, recreation and sanitation.

N

NATURAL GAS

Ontario. Natural Gas in 1924, H. B. Harkness. Ontario Dept. of Mines, vol. 34, part 5, 1926, 57 pp., 2 figs. Gas produced in Ontario in 1924 from 2,201 wells was 7,370,914 thousand cu. ft. with retail value of $4,076,014; purification, leakage, gas wells and their production, refining operations.

NICKEL STEEL

Nickel-Chromium. Heat Resistant Steels. Gas & Oil Power, vol. 22, no. 253, Oct. 7, 1926, pp. 4-5, 2 figs. Possibilities of new nickel-chromium alloys for gas-turbine service.

NON-FERROUS METALS

Properties. Metals and Their Properties, T. Newton. Sheet Metal Worker, vol. 17, no. 18, Oct. 8, 1926, pp. 704-705. Composition and melting points; constituents and characteristics of some non-ferrous alloys.

Light. Future Developments in the Light Metals, F. C. Frary. Indus. & Eng. Chem., vol. 18, no. 10, Oct. 1926, pp. 1016-1019. Deals with magnesium, beryllium, aluminum and their uses.

O

OIL ENGINES

Fuel Selection. The Practical Selection of Oil-Engine Fuels, E. J. Kates. Power, vol. 64, no. 18, Nov. 2, 1926, pp. 659-661, 4 figs. Suggestions for selecting from various grades of fuel oil on market, one that will give best combination of low price and satisfactory operation in oil-engine plant.

Modern. The Modern Oil Engine, E. C. Magdeburger. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1315-1328, 29 figs. Review of means used by foreign and domestic oil-engine builders to fit this prime mover to constantly broadening field of its application.

OIL FUEL

Recovery from Coal. Fluid Fuels, A. E. Dunstan. Gas & Oil. Power, vol. 22, no. 253, Oct. 7, 1926, pp. 6-7. Deals with Bergius process and synthol. (Abstract.) Paper read before Instn. Fuel Economy Engrs.

Research. Fuel and Lubrication Research, W. A. Whatmough. Automobile Engr., vol. 16, no. 220, Oct. 1926, pp. 376-378, 1 fig. Explanatory résumé of recent investigation in carburation and oils.

OIL SHALES

Nova Scotia. Investigations on the Treatment of Nova Scotia Oil Shales, A. E. Flynn. Nova Scotia Tech. College, Nat. Research Council—Report, no. 18, 1926, 88 pp., 32 figs. Information on nature of Nova Scotia oil shales and study of their behaviour under different retorting conditions.

OIL WELLS

Gas Lifts. Use of Gas Lifts in the Mid-Continent Field, S. F. Shaw. Am. Inst. Min. & Met. Engrs.—Trans., no. 1609-G, Oct. 1926, 7 pp., 4 figs. Increased production by application of air lift; method of calculating data on control of gas accompanying oil; initiation of control and period of application; use of back pressure.

OILS

Cracking. The Cracking of Petroleum, T. G. Delbridge. Franklin Inst.—Jl., vol. 202, no. 5, Nov. 1926, pp. 569-588, 7 figs. Review of development of processes.

OXY-ACETYLENE WELDING

Alloy Steels. Gas-Welding Alloy Steels, W. Stewart. Welding Engr., vol. 11, no. 10, Oct. 1926, pp. 41-42. Points out that all alloys can be welded; heat treatment of welds; brazing alloy steels; why some bronze welds fail; use of cast-iron filler rod; experience with welded bits.

Copper. Oxy-Acetylene Welding of Copper, A. Eyles. Machy. (N.Y.), vol. 33, no. 3, Nov. 1926, pp. 199-200, 3 figs. Precautions necessary in welding of copper; preparing copper for welding; torch and flame adjustment.

P

PAINTING

Compressed-Air Applications. Lacquering with Compressed Air. Eng. Progress, vol. 7, no. 9, Sept. 1926, p. 250, 3 figs. Describes compressed-air paint sprayers for use in many branches of industry, both for thin and thick paints and varnishes; most important parts of such apparatus are paint reservoir, spraying nozzle, air pipe and needle valve.

PAPER MACHINERY

DRIVES. Types of Paper Machine Drive and the Essential Requirements, H. W. Rogers. Paper Trade Jl., vol. 83, no. 17, Oct. 21, 1926, pp. 43-44. Discusses two classes of drives, namely, mechanical drive with steam engine, steam turbine or electric motor as prime mover, and sectional electric drive.

PAPER MANUFACTURE

ROD MILL. The Rod Mill as a Refiner and Beater, J. D. Rue. Paper Mill, vol. 49, no. 45, Nov. 6, 1926, pp. 20, 22 and 24. Machine consists of cylinder mounted on hollow trunnion and rotated about its long axis placed horizontally refining knots and screenings, etc.

PAPER MILLS

ELECTRIFICATION. The Trend in Paper Mill Electrification, R. H. Rogers. Paper Trade Jl., vol. 83, no. 17, Oct. 21, 1926, pp. 41-42. Electric power has enabled paper mill to more fully utilize its water power, regardless of seasonal fluctuation or remoteness of location; it has facilitated enlargement of old mills on site as well as construction of new mills on more advantageous sites.

PATENTS

CLASSIFICATION AND SPECIFICATIONS. Classification of Patent Specifications, A. P. Thurston. Indus. Mngt. (Lond.), vol. 13, nos. 9 and 10, Sept. and Oct. 1926, pp. 393-396 and 430-431. Contains information which should be of interest and value to manufacturers when filing applications for letters patent, or when dealing with existing inventions in course of their business. Paper presented before Brit. Assn.

PAVEMENTS, ASPHALT

SPECIFICATIONS. Specifications for Asphalt Pavements. Can. Engr., vol. 51, no. 15, Oct. 12, 1926, pp. 180, 182, 184, 189, 190 and 192, 2 figs. Specifications for asphalt, macadam, asphaltic concrete, sheet asphalt, Trafficway, Amiesite, Warrenite-bitulithic and standardite.

PHOTOGRAPHY

ENGINEERING. Some Notes on Engineering Photography, A. W. Swan. Engineer, vol. 142, no. 3693, Oct. 22, 1926, pp. 434-437, 8 figs. Notes on equipment, focussing, setting up, exposure, shop photographs, flashlight, flood lamp, etc.

PIPE, CAST-IRON

CENTRIFUGALLY CAST. Centrifugal Cast-Iron Pipe. West. Constr. News, vol. 1, no. 20, Oct. 25, 1926, pp. 61-63, 5 figs. Details of manufacture of de Lavaud and mono-cast pipe and comparisons with old sand-cast methods.

PIPE LINES

CLAY. Novel Plan for Applying Asphalt Filler on a Clay Pipe Line, C. C. Wright. Eng. News-Rec., vol. 97, no. 20, Nov. 11, 1926, pp. 794-795, 2 figs. Collapsible pneumatic inside forms used; half of joints poured on bank and half in trench.

PISTON RINGS

RESEARCH. Researches on the Piston Ring, K. Ebihara. Soc. of Mech. Engrs. (Japan)—Jl., vol. 29, no. 113, Sept. 1926, pp. 533-564, 24 figs. (In English.)

PLATES

CIRCULAR. The Flexure of Thick Circular Plates, C. A. Clemmow. Roy. Soc.—Proc., vol. 112, no. A762, Oct. 1, 1926, pp. 559-598. Investigation of flexure of thick circular plate held so that there is no displacement at cylindrical edge, subjected to uniform pressure over one of flat surfaces.

PNEUMATIC TOOLS

RAILWAY SHOPS. Some Applications of Pneumatic Tools at the C., St. P., M. & O. Shops, F. W. Curtis. Am. Mach., vol. 65, no. 17, Oct. 21, 1926, pp. 675-676, 5 figs. Cylinder-boring rig; attachment for milling axle keyways; milling ports in valve bushings; air-operated horizontal drill; device for testing superheaters.

POWER GENERATION

UNITED STATES. Power Generation, V. E. Alden. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1130-1135. Report of committee; important technical achievements of past year; auxiliary power supply; use of steam at higher temperatures; joint use of steam stations and water-power plants; probable useful life of steam stations now being built.

PROSPECTING

ELECTRICAL. Electrical Prospecting in the Rouyn, Quebec, District, E. E. Mueser. Can. Min. Jl., vol. 47, no. 41, Oct. 8, 1926, pp. 967-972, 6 figs. Describes Elbof method which employs portable induction coil to make its field observations.

GEOPHYSICAL METHODS. Geophysical Methods in Mining, C. A. Heiland. Min. Congress Jl., vol. 12, no. 11, Nov. 1926, pp. 777-784, 12 figs. Application of gravitational, magnetic and other direct geophysical methods in mining and nature of physical problems involved.

PULVERIZED COAL

BOILER FIRING. A New Pulverized-Fuel Firing System. Mech. World, vol. 80, no. 2075, Oct. 8, 1926, pp. 279-280, 3 figs. Recent development made by Clarke, Chapman & Co.; boiler is of Woodeson patent, water-tube type.

Pulverized-Fuel Installation at St. Pancras Power Station. Engineering, vol. 122, no. 3173, Nov. 5, 1926, pp. 567-568, 2 figs. Lopulco system of firing with pulverized coal was decided upon.

PULVERIZERS. The Dressing of Pulverized Fuel in Large Power Stations, C. Naske. Eng. Progress, vol. 7, no. 9, Sept. 1926, pp. 239-240, 6 figs. Maximum capacity mill in Moabit power station of Berlin Electrical Works; advantages of compound mills.

PUMPS

AIR-LIFT. Some Pertinent Facts on Air-Lift Pumping Systems, G. Lee. Indus. Mgmt. (N.Y.), vol. 72, no. 5, Nov. 1926, pp. 304-310, 12 figs. Discussion of principles and design for industrial applications.

PYROMETERS

SURFACE-TEMPERATURE MEASUREMENTS. Pyrometers for Surface-Temperature Measurements. Engineering, vol. 122, no. 3171, Oct. 22, 1926, pp. 507-508, 3 figs. New form of pyrometer patented by Cambridge Instrument Co., London, which has been successfully employed on calendering bowls, paper-making rollers, vulcanizing press platens, rubber-press rollers and other similar machines; instruments are of thermoelectric type.

R

RADIATORS

HEATING EFFECT. The Heating Effect of Radiators, C. Brabbée. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 11, Nov. 1926, pp. 731-735, 5 figs. Results of further investigations on heating effect of radiators supplementing data given in previous paper.

RAILWAY CONSTRUCTION

SPECIFICATIONS. Committee I—Roadway. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 288, Aug. 1926, pp. 1-31, 6 figs. Economics for filling bridge openings; specifications for washed gravel ballast, for cross-ties and switch ties; for dating nails, spring washers, specifications for manufacture of open-hearth steel girder rails of plain, grooved and guard types; classification of rails.

RAILWAY MANAGEMENT

MATERIALS RECLAMATION. Atlantic Coast Line Finds Profit in Reclaiming Materials. Ry. Age, vol. 81, no. 17, Oct. 23, 1926, pp. 761-765, 4 figs. Savings approach $3,000,000 annually; stores reclaim track material; manganese frogs welded; reclamation systematized by accounting.

RAILWAY OPERATION

TRAIN CONTROL. Union Pacific Uses Train Control Successfully on 225 Miles. Ry. Signalling, vol. 19, no. 11, Nov. 1926, pp. 426-432, 16 figs. Also Ry. Age, vol. 81, no. 17, Oct. 23, 1926, pp. 773-777, 11 figs.

RAILWAY TRACK

REMODELLING. Making a Track Change-Over in Minimum Time, A. L. Stead. Ry. Rev., vol. 79, no. 15, Oct. 9, 1926, pp. 539-540, 3 figs. Layout at Cannon Street station, London, remodelled for electric traction.

SPECIFICATIONS. Committee V Track. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 288, Aug. 1926, pp. 32-40, 3 figs. Specifications for steel tie plates, soft-steel cut track spikes, frog-filler sections; canting of rail inward.

RAW MATERIALS

WASTE AND BY-PRODUCTS. Raw Materials—Waste and By-Products, J. E. Teeple. Indus. & Eng. Chem., vol. 18, no. 11, Nov. 1926, pp. 1187-1190. Waste is defined as material substance that leaves manufacturing or treating plant unsold, or not sold to advantage; by-product is regarded as secondary product of manufacture made from material which would otherwise be waste, that is, unsold or improperly sold.

RECTIFIERS

HIGH-TENSION. A High-Tension Rectifier for a Low-Power Transmitter, T. S. Skeet. Experimental Wireless, vol. 3, no. 37, Oct. 1926, pp. 599-604, 4 figs. Apparatus works from 200-volt, 50-cycle alternating current, and delivers smooth direct current at approximately 620 volt and any current up to 60 milliamperes.

MERCURY-VAPOUR. Mercury Arc Rectifiers, D. C. Prince. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1087-1094, 26 figs. Outlines probable mechanism of electron source or cathode spot; indicates source of various losses and describes probable mechanism of arc back, that is, failure to rectify; principles of simple rectifier circuits; describes rectifiers of different kinds and sizes.

Upkeep and Operation of Mercury-Vapour Rectifiers, J. R. Dowdell. Elec. World, vol. 88, no. 21, Nov. 20, 1926, pp. 1069-1071, 3 figs. Policies of Houston Lighting & Power Co. in examining, installing, drying out and operating mercury-vapour rectifiers.

REFRACTORIES

BOILER-FURNACE. Refractories Service Conditions in Furnaces Burning Pittsburgh Coal on Chain Grates, R. A. Sherman and W. E. Rice. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1115-1122, 19 figs. Progress report of A.S.M.E. special research committee on boiler-furnace refractories.

THERMAL CONDUCTIVITIES. A Comparison of the Temperature Diffusivities and Thermal Conductivities of Silica and Fireclay Refractories, A. T. Green. Gas World (Coking Sect.), vol. 85, no. 2200, Oct. 2, 1926, pp. 10-12.

REFRIGERATING MACHINES

MERCURY COMPRESSOR. A Mercury Compressor Evolved from the Archimedes Screw Pump, J. G. DeRemer. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1228-1233, 10 figs. Development of novel type of gas compressor which functions on principle of Archimedes helical pump, using mercury as compressing liquid.

REFRIGERATION

DEVELOPMENTS. Report of Refrigeration Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-12, for mtg. May 17-21, 1926, 3 pp. Points out that nothing extraordinary or new in principle has appeared during war; discusses value of refrigeration business and load factor; considerations which should govern choice of machine for central-station promotion.

ELECTRIC. Electric Refrigeration. Elec. World, vol. 88, no. 18, Oct. 30, 1926, pp. 895-913, 11 figs. Nation-wide investigation of existing conditions indicates imperative need for stabilization of production, selling and servicing practices; saturation only 1.78 per cent of domestic customers; conclusions of survey.

REGULATORS

AUTOMATIC. A Direct-Acting Automatic Regulator, O. K. Marti. Elec. World, vol. 88, no. 20, Nov. 13, 1926, pp. 1015-1017, 4 figs. Details of design and operation; can be adapted to voltage, power and speed regulation, automatic synchronizing and limitation of short-circuit current.

RIVERS

ICE GORGE, BREAKING. Engineering Features in Breaking the Allegheny Ice Gorge, H. T. Barnes. Eng. Jl., vol. 9, no. 11, Nov. 1926, pp. 453-461, 15 figs. Conditions prior to commencement of work, methods of attack and results obtained.

ROAD CONSTRUCTION

IMPROVED PRACTICE. International Congress Suggests Improvements in Road Practice. Eng. News-Rec., vol. 97, no. 20, Nov. 11, 1926, p. 779. Conclusions reached at Milan sessions epitomize European opinion on concrete and asphalt.

ROADS, TARRED

TAR PENETRATION AND SURFACE TREATMENT. Tar Penetration and Surface Treatment, B. E. Smith. Can. Engr., vol. 51, no. 15, Oct. 12, 1926, pp. 172 and 178. Tar roads are claimed to be inexpensive, easy to build, waterproof and dustless.

ROLLING MILLS

BAR MILLS. New Rolling Mills—Gautier Plant, Cambria Works, Bethlehem Steel Co., Johnstown, Pa., R. H. Stevens. Iron & Steel Engr., vol. 3, no. 10, Oct. 1926, pp. 446-452, 1 fig. Four new bar mills have been installed and power house for furnishing additional electric current for same.

BLOOMING MILLS. Manipulators for Two High Reversing Blooming Mill, C. J. Klein. Iron & Steel Engr., vol. 3, no. 10, Oct. 1926, pp. 439-441 and (discussion) 441-443.

Manipulators for Blooming Mills, L. Iverson. Iron & Steel Engr., vol. 3, no. 10, Oct. 1926, pp. 437-439, 3 figs. Ideal manipulator is one which can perform required operations of pushing, turning and grasping ingot or bloom in minimum of time, with least attention for upkeep and repairs; solution of problem as it has been accomplished by Mesta Machine Co.

ELECTRIC DRIVE. Electrically-Driven Rolling Mills. Electricity, vol. 40, nos. 1836, 1838, 1839, 1842 and 1844, Jan. 15, 29, Feb. 5, 26 and Mar. 12, 1926, pp. 35-37, 72-74, 95-96, 162 and 189-190, 17 figs.

Plate Mills. Plate Mills—Recent Developments and Tendencies, F. M. Gillies. Am. Iron & Steel Inst.—Advance Paper, for mtg. Oct. 22, 1926, 16 pp. Most outstanding of recent improvements is electric drive and use of electrical equipment in general mill work. See also abstract in Iron Age, vol. 118, no. 18, Oct. 28, 1926, pp. 1197-1198.

ROOF TRUSSES

Oxy-Acetylene Welding. Tests of Welded Trusses and a New Truss Joint, H. H. Moss. Eng. News-Rec., vol. 97, no. 18, Oct. 28, 1926, pp. 712-713, 3 figs. Roof trusses 40 ft. in span and 10 ft. deep using new insert plate joint tested under three times design load; results of tests conducted at Buffalo shops of Linde Air Products Co.

S

SAWS

Modern Sawing Machinery. Modern Sawing Machinery, J. A. McKeage. Mech. Eng., vol. 48, no. 11, Nov. 1926, pp. 1135-1142, 29 figs. Motorized and belt-driven machines; rip saws; cut-off saws; combination saws; Dado machines, electric hand saw; future prospects.

SCREW THREADS

Cutting. Equipment for Cutting Accurate Threads. Machy. (N.Y.), vol. 33, no. 2, Oct. 1926, pp. 129-130, 5 figs. Equipment for cutting threads required to be very accurate as to form, lead and finish.

SCREWS

Wood. Holding Power of Wood Screws, I. J. Fairchild. U. S. Bur. of Standards—Technologic Papers, no. 319, July 17, 1926, pp. 553-580, 18 figs. Results of tests of holding power of over 10,000 wood screws inserted in side and end grain of 7 kinds of wood; effect of various sizes of lead holes, of screw lubrication, of cracks in wood and of dimensions and finish of screws.

SEWAGE DISPOSAL

Electrically-Driven Plants. Electric-Driven and Automatically-Controlled Sewage Works. Eng. News-Rec., vol. 97, no. 17, Oct. 21, 1926, pp. 658-659, 2 figs. Small pumps and sprinkling filter distributors thrown into and out of service with variations in flow.

Grit Chambers. Grit Chambers for Sewage Works, H. C. H. Shenton. Surveyor, vol. 70, no. 1814, Oct. 29, 1926, pp. 375-376. Recent developments; new type of grit chamber recently built at Pretoria, South Africa; experimental grit chambers in Cleveland, Ohio; grit chambers for activated sludge systems.

London, Ontario. New Sewage Disposal Plant, London, Ont., W. M. Veitch. Can. Engr., vol. 51, no. 14, Oct. 5, 1926, pp. 339-344, 7 figs. New activated-sludge plant serving southern district; built as experimental unit for study of design of future 10-M.G.D. plant.

Sub-Sewer-Level Drainage. Disposal of Sub-Sewer-Level Drainage, R. M. Starbuck, Jr. Domestic Eng. (Chicago), vol. 117, no. 5, Oct. 30, 1926, pp. 22-24, 62, 65 and 66, 12 figs. Duplex-pumps; pneumatic sewage ejectors.

SHOVELS

Electric. The Electric Power Shovel, R. W. McNeill. Eng. & Min. Jl., vol. 122, no. 20, Nov. 13, 1926, pp. 764-768, 12 figs. Advantages of variable-voltage system and equipment called for; simple method of limiting motor torques where mechanical damage might otherwise result; other features.

Variable-Voltage Equipment for Electric Power Shovels, R. W. McNeill. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1151-1154, 3 figs. Latest development is characterized by two outstanding features: simplicity of control and sturdiness of entire electrical equipment; first is secured by use of variable-voltage system of motor speed control and durability.

SMOKE

Abatement. Smoke Abatement, Its Effects and Its Limitations, H. B. Meller. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1275-1283, 4 figs. Advantages accruing to manufacturers and public from smoke abatement; anti-smoke laws are incomplete in that they deal only with part of air-pollution evil that is less grave and less menacing to health.

Problems. Present Status of the Smoke Problem, O. Monnett. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1284-1285. Points out that real problem to-day is small heating plant; importance of supervision; future possibilities.

SOLDERS

Tin. Some Practical Suggestions for the Conservation of Tin in Solders and Dipping Baths, A. Eyles. Metal Industry (Lond.), vol. 29, nos. 15 and 18, Oct. 8 and 29, 1926, pp. 340-342 and 415. Oct. 8: Notes on fluxes and making solders. Oct. 29: Reclamation of tin and tin-lead alloys from scrap.

SOLIDS

Internal Friction. Internal Friction in Solids, A. L. Kimball and D. E. Lovell. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6 9, 1926, 17 pp., 13 figs. In connection with test devised to determine quantitatively amount of friction within metal of steel shaft, it was found that internal frictional forces were totally unlike those of viscous fluid, as assumed by many investigators, where forces are greater the more rapid the deformation; instead of this, dissipative forces were found to be the same whatever the speed of deformation.

STEAM

High-Temperature. 1,250-Degree Steam for Process Work in France, R. H. Andrews. Power, vol. 64, no. 20, Nov. 16, 1926, p. 731, 1 fig. Describes 2,500-sq. ft. superheater recently built in France to deliver low-pressure steam at 8 lb. per sq. in. and 1,100 deg. Fahr.; factors that determine ability of metal to withstand high temperatures and pressures.

STEAM ACCUMULATORS

Electric Boilers. Steam Accumulator is Used with Electric Boilers. Power, vol. 64, no. 19, Nov. 9, 1926, pp. 688-692, 8 figs. One of the first high-pressure steam-accumulator plants to be installed in America is new newsprint mill erected by Price Bros. & Co., Riverbend, Que.; accumulator floating on line between two governor valves absorbs or delivers difference between steam passing high-pressure valve and demand for low-pressure process steam.

STEAM ENGINES

Uniflow. Uniflow Engine Designed for Bleeder Operation. Power Plant Eng., vol. 30, no. 21, Nov. 1, 1926, pp. 1145-1146, 2 figs. Engine built for English woollen mill to work at 160-lb. initial pressure with 550 deg. Fahr., receiver pressure of 60 lb. and steam bled from receiver for process work in mill.

STEAM PIPES

Central Stations. Station Piping. Nat. Elec. Light Assn.—Report, no. 256-56, June 1926, 29 pp., 20 figs. Characteristics of high-pressure piping systems; new standards; specifications for forged or rolled steel-pipe flanges for high-temperature service; design and specifications of pipe systems for Edgar Station at Weymouth, Boston; tests on pipe flanges. Bibliography.

High-Pressure. Steam Pipes for Extra High Pressure and Temperature, J. A. Aiton. Inst. of Mar. Engrs.—Trans., vol. 38, Oct. 1926, pp. 229-243 and (discussion) 243-258, 4 figs. Points out that no drastic alterations are necessary either in materials or in method of manufacture to meet modern conditions in piping, but great care and experience are necessary in all departments of work, especially in design.

STEAM POWER PLANTS

Cost Reduction in. A Little Engineering Study Saves $24,000 Yearly in Hospital. Power, vol. 64, no. 17, Oct. 26, 1926, pp. 616-617, 4 figs. Account of great savings obtained in small power plant, supplying steam heat, electric lighting and power, hot water to laundry and other services in Long Island College Hospital, through application of well-recognized engineering practices.

Waste Prevention. Causes of Waste and Their Prevention, C. F. Wade. Eng. & Boiler House Rev., vol. 39, nos. 9 and 10, Mar. and Apr. 1926, pp. 442-443 and 478-479.

STEAM TURBINES

Exhaust-Steam Utilization. Use of Exhaust-Steam Effects Greater Savings, L. Heil. Power Plant Eng., vol. 30, no. 22, Nov. 15, 1926, pp. 1198-1199, 4 figs. Installation of mixed-pressure turbine utilizing exhaust steam from forge shop earns its cost in 3¼ yr.

Extraction. Select an Extraction Turbine to Fit the Job, W. Slader. Power, vol. 64, no. 17, Oct. 26, 1926, pp. 618-620, 1 fig. Points out that extraction turbine can effect great savings, but it must be designed carefully to fit variations in power and heating demands; shows how to make intelligent study.

Vibrations in. The Gyroscopic Vibration of Marine Steam-Turbine Discs, K. Suyehiro. Engineering, vol. 122, no. 3173, Nov. 5, 1926, pp. 581-582, 4 figs. Deals with effect of yawing or pitching of turbine ship on turbine discs which are thereby set into processional motions. Paper read before Japanese Soc. Nav. Architects.

STEEL

Chrome. *See Chrome Steel.*

Embrittlement. Caustic Embrittlement of Steel, S. W. Parr and F. G. Straub. Chem. & Met. Eng., vol. 33, no. 10, Oct. 1926, pp. 604-607, 6 figs. Study of its cause and prevention in boilers reveals valuable data for other chemical engineering applications.

Embrittlement of Steel, A. G. Christie. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1368-1372. Review of investigations and opinions on embrittlement of steel used in boilers; progress report of Sub-committee No. 6 of Joint Research Committee on Boiler-Feedwater Studies.

Nickel. *See Nickel Steel.*

STEEL, HEAT TREATMENT OF

Mechanical Properties, Influence on. The Effects of Heat Treatment Upon the Mechanical Properties of Steels, F. W. Duesing. Mech. World, vol. 80, no. 2078, Oct. 29, 1926, p. 345. Results of tests carried out by author on eight qualities of mild steel. Brief abstract translated from German.

Normalizing and Annealing. Normalizing and Annealing. Machy. (Lond.), vol. 28, no. 729, Sept. 30, 1926, pp. 791-792. Points out that normalizing is very much simpler and cheaper process than oil quenching and tempering.

Principles. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 10, no. 4, Oct. 1926, pp. 638-656, 11 figs. Fundamental principles of normalizing, annealing, hardening, tempering and heat-treating of low and medium carbon steels; use of critical-range diagrams and charts giving physical properties produced by different heat treatments are explained; photomicrographs are given to show effects of different heat treatments upon structure of steel.

STORAGE BATTERIES

Maintenance. Experts Give Instructions for Maintaining Storage Batteries. Power, vol. 64, no. 17, Oct. 26, 1926, pp. 644-645. Instructions abstracted from "Manual of Storage Battery Practice" of Association of Edison Illuminating Co.

STRUCTURAL STEEL

Corrosion. Corrosion of Structural Steel, F. N. Speller. Am. Iron & Steel Inst.—Advance Paper, for mtg. Oct. 22, 1926, 20 pp., 4 figs. Discusses framework of steel structures, such as bridges and steel frame buildings; mechanism and classification of corrosion; influence of composition; preventive measures. See also abstract in Iron Age, vol. 118, no. 18, Oct. 28, 1926, pp. 1200-1201.

Technical Problems. Technical Problems of Steel Construction Discussed by Fabricators. Eng. News-Rec., vol. 97, no. 19, Nov. 4, 1926, pp. 738-740. Review of reports and papers before Am. Inst. of Steel Construction; technical research; fireproofing; beam connection angles; corrosion; structural steel vs. concrete; new views on wind bracing, etc.

SUBSTATIONS

Standardization of Design. Substation Design and Construction, M. L. Sinderland and P. Sporn. Elec. World, vol. 88, no. 21, Nov. 20, 1926, pp. 1055-1059, 7 figs. Objects and applications of standardization of this class of work; its advantages and its limitations; minimum system cost desideratum; experiences in practice.

Supervisory Control. A Forty-Five Thousand Kv.A. Station with Supervisory Control, W. F. Sutherland. Elec. News, vol. 35, no. 21, Nov. 1, 1926, pp. 29-33, 8 figs. Wiltshire station of Toronto hydro-electric system has been designed and built primarily for supervisory control.

T

TAR

Low-Temperature. The History and Composition of Low-Temperature Tar, E. Parrish. Fuel, vol. 5, no. 10, Oct. 1926, pp. 436-465, 1 fig. Tars produced by low-temperature carbonization of coal show great variations, both in their content of neutral, acid and basic compounds, and in their behaviour on distillation; factors influencing yield and composition. Bibliography.

TELEPHONY

Multi-Exchange System. Some Fundamentals of Automatic Switching Methods in Multi-Exchange Systems, F. H. Harrison. Instn. Post Office Elect. Engrs., no. 103, paper read at mtg. Feb. 23, 1925, 27 pp., 13 figs. Describes various types and discusses apparatus requirements when introducing automatic switching into large areas.

Transcontinental. Transmission Features of Transcontinental Telephony, H. H. Nance and O. B. Jacobs. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 11, Nov. 1926, pp. 1061-1069, 9 figs. Various steps in establishment of existing network of transcontinental-type circuits and transmission design considerations; communication channels obtained from transcontinental type facilities and bands of frequencies employed; carrier-current systems, telephone repeaters and signalling systems.

Engineering Index

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A

AERONAUTICS

Progress in. Progress in Aeronautics. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1432-1434. Progress report contributed by Aeronautics Division of Am. Soc. Mech. Engrs., dealing with governmental activities, air transport, aids to navigation, aerodynamics, airplane construction, power plant and airships.

AIR CONDITIONING

Chart. A Simplified Air-Conditioning Chart. Heat. & Vent. Mag., vol. 23, no. 12, Dec. 1926, p. 73, 1 fig. Chart for determining heat content of air with varying temperature and moisture conditions has been devised by A. Lewis, of Commonwealth Works Department of Australia.

AIRCRAFT

Constructional Engineering. The Constructional Engineering of Aircraft, R. K. Pierson. Instn. Civ. Engrs., 1925, 54 pp., 22 figs. General comparison with normal structural engineering; component parts of aircraft; initial assumptions and limiting conditions; methods of stress calculation; metal construction; special problems.

AIRPLANE PROPELLERS

Metal vs. Wood. Metal vs. Wood Propellers. Aviation, vol. 21, no. 22, Nov. 29, 1926, pp. 913-914, 1 fig. Discussion by correspondence between R. B. C. Noorduyn, Atlantic Aircraft Corp., and T. P. Wright, Curtiss Aeroplane and Motor Co.

AIRPLANES

Airfoils. Pressure Distribution Over a U.S.A.-27 Aerofoil with Square Wing Tips—Model Tests, C. G. Heard. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1401-1403, 4 figs. Investigation undertaken to determine distribution of loading over airfoil with square wing tips, tests being conducted in wind tunnel; effect of stagger on distribution of loading is considerable.

Economy Chart. An Economy Chart for Airplanes, C. H. Powell. Aviation, vol. 21, no. 24, Dec. 13, 1926, pp. 996-998. Effect of wing area on speed, economy and speed range shown diagrammatically.

Light. Lightplanes and Private Flying. Aviation, vol. 21, no. 24, Dec. 13, 1926, pp. 999-1000, 2 figs. Low-powered flying as basis upon which cheap airplanes may be produced.

Quantity Production. Airplane Production Moving Slowly Toward Quantity Basis, A. F. Denham. Automotive Industries, vol. 55, no. 24, Dec. 9, 1926, pp. 962-964, 5 figs. Modified progressive-assembly line system now used in steel-tubing fuselage construction; development of machine methods will reduce costs materially; hard tubing difficult to work.

Speed Control. Indicators or Controls for Speed Loss (Les appareils advertisseurs ou correcteurs de perte de vitesse), P. Mazer. Aérotechnique, vol. 8, no. 89, Oct. 1926, pp. 333-338, 5 figs. Describes Constant indicator, double-face horizontal vane mounted on an articulated trapezium, being very sensitive to small variations; Constantin vane acting on depth control; Savage-Bramson vane. See also Aérophile, Sept. 15, 1926, p. 277.

Steam-Driven. Is the Steam-Driven Airplane Possible? (L'avion à vapeur est-il possible?), H. Robart. Aérophile, vol. 34, nos. 17-18, Sept. 1-15, 1926, pp. 275-276. Author believes that steam drive is possible and discusses advantages over gasoline drive.

ALLOYS

Aluminum. *See Aluminum Alloys; Aluminum Bronze.*
Copper. *See Copper Alloys.*

ALUMINUM ALLOYS

Heat Treatment. A Rapid Method for the Heat Treatment of the Aluminum-Copper-Nickel-Magnesium (Piston) Alloy, S. Daniels. Am. Soc. Steel Treat.—Trans., vol. 10, no. 6, Dec. 1926, pp. 872-882. Outlines principles of heat treatment of "Y" alloy, together with course of experimentation that led to adoption of two-hour treatment which increased strength of alloy as cast from 25,000 to 35,000 lb. per sq. in., and Brinell hardness from 74 to 105; effect of time at soaking temperature, quenching medium, aging temperature and period, and influence of cross-section upon mechanical properties.

Properties. Useful Alloys of Aluminum and Their Properties, G. R. Webster. Foundry Trade Jl., vol. 34, no. 533, Nov. 4, 1926, p. 393. Properties of different alloys of aluminum, which are divided into three general groups: (1) aluminum with not more than 10 to 25 per cent of added metals; (2) metals containing not more than 10 to 15 per cent of aluminum; (3) alloys of rare metals with aluminum containing from 0.5 to 5.0 per cent of added metal.

ALUMINUM BRONZE

Properties. Aluminum Bronze—An Acid-Resisting Material, W. M. Corse. Am. Soc. Steel Treat.—Trans., vol. 10, no. 6, Dec. 1926, pp. 898-905. Practically important aluminum bronzes are those containing less than 11 per cent aluminum; they possess, in addition to tensile properties of medium steel, far greater resistance to corrosion, wear and fatigue than such steel; aluminum bronze may be forged and machined with practically same equipment as for steel, and with proper care and fluxes it may be welded; properly designed castings have been made to stand hydraulic pressure of 1,000 lb. per sq. in.

AUTOMOBILE ENGINES

Design. Engine Characteristics as Affected by Cylinder and Crankcase Arrangement, H. M. Crane. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 578-592 and (discussion) 592-594, 23 figs. Explains characteristics and advantages of different types of engine; author endeavours to determine, if possible, what saleable article will be several years hence; consideration of noise due to vibration of engine.

Testing. New Engine-Testing Forms. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 556-558, 5 figs. Charts proposed by S.A.E. Engine Division which will be applicable to all internal-combustion engine types.

Wear and Corrosion. Causes of Wear and Corrosion in Engines, O. M. Burkhardt. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 657-680 and (discussion) 682-684, 18 figs. Study of analyses obtained from 656 samples of contaminated crankcase-oil and results of co-operative research.

AUTOMOBILES

Brakes, Four-Wheel. Present-Day Brakes. Autocar, vol. 57, nos. 1615 and 1616, Oct. 15 and 22, 1926, pp. 641-645 and 758-761, 18 figs. Consideration of principles and details underlying latest types of British, American and Continental 4-wheel braking systems.

Gear Boxes. Gear Box With Constant Mesh Pinions. Engineering, vol. 122, no. 3175, Nov. 19, 1926, pp. 646-647, 1 fig. Details of type manufactured by Lea and Francis, Coventry.

Rear-Axle Housing. The Automobile Rear-Axle Housing, R. L. Rolf. Forging—Stamping—Heat Treating, vol. 12, no. 11, Nov. 1926, pp. 408-412, 20 figs. Deals with pressed-steel housings.

Shock Vibrations. Fundamentals in Determination of Dynamic Stress of Automobiles Under Shock (Grundlagen zur Ermittlung der dynamischen Beanspruchung von Kraftfahrzeugen bei Stössen), Marquard. Motorwagen, vol. 29, nos. 30 and 32, Oct. 31, Nov. 20, 1926, pp. 737-742 and 793-798, 19 figs. Experimental determination of axial and framework vibration diagrams; shows how such diagrams for a given case can be graphically built up, based on purely theoretical principles.

Springs. Springs from Automotive Viewpoint. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 543-546, 2 figs. Experimental determination of stresses in leaf spring; fatigue-test results not adequately interpreted; standardization and research accomplished; dynamical problems of spring suspensions; elastic problems. Report prepared for Special Research Committee on Mechanical Springs.

AUTOMOTIVE FUELS

Anti-Knock Compounds. Retarding Effect of Anti-Detonating Materials (Sur l'effet retardateur d'inflammation produit par les corps dits antidétonants), M. Dumanois. Académie des Sciences—Comptes Rendus, vol. 182, no. 25, June 21, 1926, pp. 1526-1528. Action of anti-detonator may be regarded as raising minimum temperature necessary for spontaneous ignition to occur, or as increasing time necessary for such ignition to occur at any given temperature above minimum; latter would appear to be more logical and is supported by experiments; experiments made with addition of tetraethyl lead to fuel in proportion of 1 part in 1,000, by volume, indicate considerable delaying effect on preignition.

Research. Fuel and Lubrication Research, W. A. Whatmough. Automobile Engr., vol. 16, no. 222, Nov. 1926, pp. 449-451, 2 figs. Explanatory résumé of recent investigations in carburation and oils.

Volatility. Increasing Volatility of Motor Fuel. Oil and Gas Jl., vol. 25, no. 26, Nov. 18, 1926, pp. 41 and 133-134, 11 figs. Review of research work covering case of starting, acceleration, engine performance; discusses use of natural gasoline. Paper read before Nat. Petroleum Marketers' Assn.

AVIATION

Freight Containers in Transport. Freight Containers in Air Transport, A. Black. Aviation, vol. 21, no. 25, Dec. 20, 1926, pp. 1038-1039, 3 figs. Problems in handling of loose packages; advantages of using containers; reduction of claims for damage or loss; simplification of handling and loading.

Lighting of Obstructions. The Lighting of Obstructions Dangerous to Aerial Navigation, C. H. Biddlecombe. Aviation, vol. 21, no. 22, Nov. 29, 1926, pp. 910-912, 1 fig. Author recounts phase of his activities in development of Air Transportation under British government, namely, marking of "reefs of the air," these being tall radio masts, lofty chimneys and similar obstructions on and near airdromes and air routes.

B

BEAMS

Curved. Tests and Theory of Curved Beams, A. M. Winslow and H. G. Edmonds. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 19 pp., 8 figs. Tests consist of strain-gauge observations at several points throughout cross-sections of large steel specimens, determining complete strain curves; radial strains, apparently not previously investigated, are definitely measured and simple working theory of radial stress is developed; stress in radial direction is shown to be vital factor in design of curved beams of certain proportions; investigates different theories of circumferential stress.

Steel Haunched in Concrete. Steel I-Beams Haunched in Concrete, P. Gillespie and R. C. Leslie. Univ. of Toronto, School of Eng. Research—Bul., no. 5, Nov. 1926, 63 pp., 5 figs. Results of series of tests on haunched beams conducted at plant of Dominion Bridge Co. at Lachine in 1922-23; tests seem to warrant following assumptions: (1) Two materials act together as they do in reinforced concrete, (2) live load deflections follow with necessary changes, approximately, formulas for homogeneous beams, (3) working stress of 240 lb. per sq. in. in horizontal shear is not excessive.

BEARING METALS

Properties. Bearing Metals, W. T. Griffiths. Inst. Mar. Engrs.—Trans., vol. 38, Sept. 1926, pp. 180-200 and (discussion) 200-207, 16 figs. Deals with tin-base, lead-base and copper-base alloys; effect of casting on microstructure; testing; lubrication.

BEARINGS

Lubrication. The Lubrication of Waste-Packed Bearings, G. B. Karelitz. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 31 pp., 25 figs. Results of investigation made by Westinghouse Electric and Manufacturing Co.; discusses feeding of oil through waste and existence of load carrying oil film in such bearings as essential for their proper performance; observations on friction and temperature of these bearings and on importance of proper packing to insure sealing window by oil-saturated waste; discusses existence of critical oil lift at which seal is broken; reason for occasional end wear and scoring of ends of shell during running-in period.

BEARINGS, ROLLER

Heating and Annealing. Timken Bearings and Gas Furnaces, F. W. Manker. Iron Age, vol. 118, no. 23, Dec. 2, 1926, pp. 1549-1551, 5 figs. Data on fuel consumption and other features of heating and annealing practice; scrap reclamation by briquetting.

Tub-Axle. The Grainer Tub-Axle Roller Bearing. Iron & Coal Trades Rev., vol. 113, no. 3064, Nov. 19, 1926, p. 765, 2 figs. Bearing is practically totally enclosed and required filling with grease at rate of 4 oz. per bearing; bearing may or may not be offset.

BELT DRIVE

Short-Centre. Reliable Belt Drives Where Centres Are Short, S. Rice. Belting, vol. 29, no. 5, Nov. 1926, pp. 22-24, 3 figs. Belt of new construction with narrow strips of specially tanned leather on pulley side; these belts are widely used on drives where centre distance between pulleys is short.

BELTING

Creep and Slip. Distribution of Belt Creep and Slip, R. F. Jones. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 18 pp., 20 figs. Explains stroboscope slip meter used in tests and method followed by investigators as well as theory involved; results show that arc over which belt creeps, starts at last point of contact and extends in direction opposite to rotation, amount depending on load; greatest slip always occurs at last point of contact; amount of load that can be carried by given belt under given conditions at merging point of slip and creep varies with coefficient of friction.

BOILER FEEDWATER

Analysis. Composition of Water and Injurious Constituents It Contains (Composition des eaux naturelles et elements nuisibles qu'elles peuvent contenir), J. Guth. Assns. Francaises de Propriétaires d'Appareils à Vapeur—Bul., no. 25, July 1926, pp. 161-180, 3 figs. Discusses chemical constituents of water and importance of accurate analysis; gases, minerals and organic compounds; water hardness, temporary and permanent; typical feedwater analysis.

Hydrogen-Ion Control. Automatic Hydrogen-Ion Control of Boiler Feedwater, H. C. Parker and W. N. Greer. Am. Water Wks. Assn.—Jl., vol. 16, no. 5, Nov. 1926, pp. 602-616, 7 figs.

Treatment. Railroad Water Treatment. West. Soc. Engrs.—Jl., vol. 31, no. 10, Oct. 1926, pp. 392-402 and (discussion) 402-407. Contains three papers giving general view of water-treating practice on American railroads, as follows: History and Growth of Water Treatment for Locomotive Boilers, R. E. Coughlan; General Aspects of Water Treatment for Railroads, R. C. Bardwell; Zeolite Method of Water Softening, C. W. Sturdevant.

BOILER FURNACES

Radiation, Influence of. The Influence of Radiation in Coal-Fired Furnaces on Boiler-Surface Requirements, and a Simplified Method for Its Calculation, W. J. Wohlenberg and E. L. Lindseth. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 86 pp., 46 figs. Includes simplified method of dealing with energy problems of boiler furnace; application yields information concerning that division of total surface between cold furnace walls and convection zone which results in greatest overall energy absorption; influences of fuel type, air preheat and certain other factors on furnace conditions and surface requirements.

BOILER PLANTS

Automatic. An Automatic Boiler Plant, H. G. Lykken. Power, vol. 64, no. 23, Dec. 7, 1926, p. 864, 1 fig. Entire power load of flour mill in New Prague, Minn., is carried by bent-tube boiler having 4,510 sq. ft. of steam-making surface, which is operated at 150 per cent of rating.

Pulverized-Coal. A New Purverized-Fuel Burning Installation. Colliery Guardian, vol. 132, no. 3439, Nov. 26, 1926, pp. 1162-1163, 4 figs. Combination of "Woodeson" watertube boiler and "Unit" pulverizer at Victoria Works of Clarke, Chapman & Co.

BOILER TUBES

Elevated Temperatures. Properties of Boiler Tubing at Elevated Temperatures Determined by Expansion Tests, A. E. White and C. L. Clark. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 17 pp., 16 figs. Investigation to determine safe working loads for low-carbon steel seamless tubing at elevated temperatures; there is increasing tendency to increase both temperature and pressure, but little is known of properties of metals at elevated temperatures, particularly when temperatures are maintained for long periods of time; sets forth preliminary findings on 0.13 carbon-steel tubing when loaded at temperatures of 900, 1,000, 1,250 and 1,500 deg. Fahr.

BOILERS

A.S.M.E. Codes. Revisions and Addenda to Boiler Construction Code. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1474-1478, 1 fig. Specifications for carbon-steel castings for valves, flanges and fittings for high-temperature service; specifications for carbon-steel and alloy-steel forgings.

Radiation Losses. The Radiation Losses of a Large Boiler Unit, A. Page. Power Engr., vol. 21, nos. 248 and 249, Nov. and Dec. 1926, pp. 423-425 and 457-459, 4 figs. Definitions and review of radiation losses; consideration of basis for radiation losses; calculation. Dec.: Proposed new method of ascertaining this factor.

Scale Prevention. Boiler Protection and Maintenance. Mar. Engr. & Motorship Bldr., vol. 49, no. 592, Dec. 1926, pp. 466-467, 1 fig. Particulars of filtrator, a simple device which prevents formation of boiler scale.

BRIDGES, CONCRETE

Precast. High-Strength Concrete Versus Compressive Reinforcement, M. Hirschthal. Eng. News-Rec., vol. 97, no. 24, Dec. 9, 1926, pp. 954-955. Comparative design of precast railway bridge shows economy in precautions in improving concrete.

BRIDGES, HIGHWAY

Concrete vs. Timber Floors. Concrete Compared with Timber for Highway Bridge Floors, O. L. Grover. Pub. Roads, vol. 7, no. 8, Oct. 1926, pp. 171-173, 1 fig. Comparison of costs; points out that cost is increased only 2 per cent by change from wood to concrete; other advantages of concrete.

Quebec. Quebec Highway Bridges and Culverts, I. E. Valee. Can. Engr., vol. 51, no. 21, Nov. 23, 1926, pp. 657-658, 2 figs. All structures of over 20-ft. span are classified as permanent; bridges are divided into three classifications; construction under supervision of Department of Public Works; number of bridges subsidized each year.

BRIDGES, LIFT

Bascule. Track Castings for Rolling-Lift Bascule Bridges. Eng. News-Rec., vol. 97, no. 22, Nov. 25, 1926, pp. 878-879, 2 figs. Latest design of track and tread castings for rolling segments of bascule bridges of Scherzer rolling-lift type.

BUILDING CONSTRUCTION

Hollow-Tile. Building with Hollow Tile. Contract Rec., vol. 40, no. 48, Dec. 1, 1926, pp. 1149-1150, 1 fig. Strength of individual tile; effect of mortar joint.

Steel. Some Possible Economies in Steel Construction, C. R. Young. Eng. & Contracting, vol. 65, no. 5, Nov. 1926, pp. 229-237, 2 figs. Typical cases of design practice involving waste of material. Paper presented before Am. Inst. Steel Construction.

BUILDINGS

Winter Protection. Unusual Winter Protection at Two Per Cent of the Cost of the Building. Contract Rec., vol. 40, no. 46, Nov. 17, 1926, pp. 1086-1087, 2 figs. Wooden shell completely surrounding Table Rock House at Niagara Falls, Ont., built and maintained for $5,000; many advantages offset this expense.

C

CABLES, ELECTRIC

High-Tension. High-Voltage Field Testing of Cables, C. L. Kasson. Elec. World, vol. 88, no. 22, Nov. 27, 1926, pp. 1117-1121, 5 figs. Development of field equipment; features of portable kenotron set which is 2 tons lighter than usual portable equipment; value and need of careful field tests.

CAMS

Kinematics of. Kinematics of Cams, Calculated by Graphical Methods, H. Schreck. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 63 pp., 36 figs. Application of graphical methods for calculation of velocity and acceleration of cams; application of theory to problems comprising various shapes of cams and changes in kinematic conditions due to variation in shape; results are shown in tables and plotted in graphs.

CAR DUMPERS

Electric. Operating Economy of New Car Dumper Reflects Simplicity of Control, A. F. Case. Iron Trade Rev., vol. 79, no. 22, Nov. 25, 1926, pp. 1362-1363, 2 figs. 120-ton Toledo car dumper built by Wellman-Seaver-Morgan Co., for New York Central Railway Co., at Toledo docks; designed to handle all sizes of open-type railway cars.

CARS, PASSENGER

All-Metal. All-Metal Passenger Cars Built in France, A. Eisenschmidt. Ry. Mech. Engr., vol. 100, no. 12, Dec. 1926, pp. 741-742, 3 figs. Body is 64 ft. long with length over buffers of 66 ft.; object of designer was to construct body of car so as to have same stresses as would be set up in hollow beam under same load and reactions; trucks are pivoted on pressed-steel plates.

CASE-HARDENING

Furnace. An Efficient Carburizing Furnace of the Surface Combustion Type, A. E. White and E. R. McPherson. Am. Soc. Steel Treat.—Trans., vol. 10, no. 6, Dec. 1926, pp. 941-950 and (discussion) 950-953, 5 figs. New furnace installation in Packard Motor Co., and results of tests run on these furnaces for purpose of determining temperature, distribution and regulation; production capacity; fuel-oil consumption; in author's opinion, ideal type of carburizing furnace is one of compensating type.

Cooling and Contraction. Note on Cooling and Contraction of Iron Castings, I. Sugimura. Soc. Mech. Engrs. (Japan)—Jl., vol. 29, no. 114, Oct. 1926, pp. 585-594, 3 figs. Presents cooling and contraction curves of rapidly and slowly cast iron from melting to ordinary temperatures obtained by special apparatus of author's own design, and results are formulated in mathematical expressions; density and shrinkage of cast iron which occluded air while pouring. (In English.)

Graphitization. Graphitization at Constant Temperature Below the Critical Point, H. A. Schwartz and H. H. Johnson. Am. Soc. Steel Treat.—Trans., vol. 10, no. 6, Dec. 1926, pp. 965-970, 1 fig. This paper is brief sequel to earlier paper by one of the authors; evidence is furnished that mechanism of reaction, in its earlier stages at least, is identical above and below critical point; it is shown that apparent permanence of metastable system at atmospheric temperatures is not inconsistent with conception that graphitization proceeds at any temperature, no matter how low.

Influence of the Various Elements on the Graphitization in Cast Iron, H. Sawamura. College of Eng., Kyoto Imperial Univ.—Memoirs, vol. 4, no. 4, Sept. 1926, pp. 159-260, 141 figs. Influence of various elements on graphitization in white cast iron; influence of aluminum, nickel, copper, cobalt, gold and platinum, chromium, tungsten, molybdenum, vanadium, phosphorus, sulphur, manganese; theoretical consideration of graphitization; supplemental experiments; graphitization velocity and degree; mechanism of graphitization. (In English.)

CENTRAL STATIONS

Generator Practice. Generator Practice in Central Stations, M. J. Lowenberg. Power Plant Eng., vol. 30, no. 24, Dec. 15, 1926, pp. 1324-1326, 2 figs. Considerations involved in arrangement of generators and auxiliaries in modern plants.

CHAIN DRIVE

High-Speed. High-Speed Chain Drives, G. M. Bartlett. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 259-262, 2 figs. Effects of sprocket size, chain velocity and sprocket speed; important deduction to be drawn from research work described is that short-pitch chains of light weight and ample width are necessary for high-speed drives. Paper presented before Am. Gear Mfrs'. Assn.

CHAINS

Heat Treatment. Heat Treatment of Chains. Mech. World, vol. 80, no. 2079, Nov. 5, 1926, p. 363. Object is removal or partial removal of hardening and embrittlement produced by strains and shocks to which chains are subjected in practice; studies effect of low-temperature annealing, (650 to 760 deg. cent.), and normalizing, upon mechanical properties of chains which have been subjected to varying degrees of plastic strain.

CIRCUIT BREAKERS

VACUUM. Vacuum Switching Experiments at California Institute of Technology, R. W. Sorensen and H. E. Mendenhall. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1203-1206, 8 figs. Report of successful experiments in switching or breaking circuit in high vacuum which extended over period of three years; conclusions are summed up in statement that vacuum breakers of laboratory type have been successful in breaking circuits and offer possible solution of circuit-breaker problem.

COAL

BRIQUETTING. Colloidal Briquetting (Die Kolloidbrikettierung), F. Weinmann. Glückauf, vol. 6, no. 35, Aug. 28, 1926, pp. 1137-1139. In colloidal process part of material to be briquetted is ground with water to form coarse colloidal dispersion; effect of colloidal particles is to bring about cohesion of coarser particles when whole mass is kneaded together and then subjected to moderate pressure; briquettes made by colloid process are immediately strong enough to be stored in bulk; they may be allowed to dry naturally or they may be passed through tunnel in presence of diluted flue gases; colloidal briquetting of brown coal can be practiced economically where output per day is as low as 50 tons; colloidal briquettes made from bituminous slack can be converted to smokeless fuel suitable for domestic use, valuable by-products being recovered during distillation. See brief translated abstract in Colliery Eng., vol. 3, no. 33, Nov. 1926, p. 508.

CARBONIZATION. Low-Temperature Carbonization. Engineer, vol. 142, no. 3699, Dec. 3, 1926, pp. 604-605, 2 figs. Review of report on test made by Fuel Research Board on fusion rotary retort installed at works of Electro-Bleach and By-Products, Ltd., by Fusion Corp., Middlewich; retort is mild-steel lap-welded tube, rotating in horizontal position within heated brickwork chamber.

Low-Temperature Carbonization and the Gas Industry, E. W. Smith. Gas World, vol. 85, no. 2207, Nov. 20, 1926, pp. 520-523. Disadvantages of raw coal; qualities required in solid smokeless fuel; gas industry and low-temperature methods; in author's opinion, there is no satisfactory low-temperature process. See also Gas Jl., vol. 176, no. 3313, Nov. 17, 1926, pp. 433-436.

ENGINEERING PROGRESS. Progress in Fuels Engineering. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1416-1417. Progress report contributed by Fuels Division of Am. Soc. Mech. Engrs., shows that in combustion of coal for production of power, further large gains in efficiency are not anticipated except through use of extreme high pressures; coal problem of United States is one of utilization in so far as country at large is concerned.

SPONTANEOUS COMBUSTION. The Oxidation of Pyrites as a Factor in the Spontaneous Combustion of Coal, S. H. Li and S. W. Parr. Indus. & Eng. Chem., vol. 18, no. 12, Dec. 1926, pp. 1299-1304, 9 figs. Recent studies on oxidation of coal seem to prove conclusively that oxidation proceeds very rapidly after temperature of 70 to 80 deg. cent. has been attained, and quickly reaches autogenous stage, while at normal temperatures oxidation is not ordinarily of sufficient magnitude to generate heat.

COAL HANDLING

CENTRAL STATION. Coal Preparation and Handling at Trenton Channel, J. H. Drake. Power, vol. 64, nos. 18 and 19, Nov. 2 and 9, 1926, pp. 652-655 and 697-699, 10 figs. Nov. 2: Operating experience with coal-preparation and handling equipment from car unloaded to burners. Nov. 9: Wear in mill exhauster fans, pneumatic-transport systems, feeders and burners, means and readiness of control and operating force.

PLANTS. Coal-Handling Plant at the Gas Light and Coke Company's Beckton Works. Engineering, vol. 122, nos. 3174 and 3176, Nov. 12 and 26, 1926, pp. 589-591 and 650-653, 39 figs. partly on supp. plates. New scheme made provision for eight electric travelling cranes with maximum capacity each of 250 tons per hour, belt conveyor on each erm, with weighing machines and discharging hoppers to barges in centre, conveyor to river bank, and fourth one at right angles leading to new storage bunkers.

COAL MINES

GAS OCCURRENCE. The Occurrence of Gas, R. Clive. Instn. Min. Engrs.—Trans., vol. 72, Oct. 1926, pp. 15-22 and (discussion) 22-28. Variation in total quantity of gas from mine; gas from faces which have stood for varying periods; comparison between rise and dip workings; blowers of gas from breaks in floor of seam; effect of reduced ventilation; composition of gas.

MECHANIZATION. Mechanization Will Help the Coal Industry, J. C. White. Coal Age, vol. 30, no. 23, Dec. 2, 1926, pp. 767-771, 14 figs. Points out that earnings based on performance are fair to miners and management; coal industry forced to use more labour-saving machinery; incentive methods help production; task-plus-bonus payment system for machine work.

COAL MINING

ELECTRICITY IN. Electricity and Coal Mining, D. Harrington. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1264-1267. Most of up-to-date coal mines use incandescent electric lighting on main haulage roads or at hoist or pump stations or other underground places where there is much concentrated activity; blasting by electricity is by no means as nearly universal in coal mines as it should be; in addition, there are numerous minor operations in which electricity takes or appears about to take leading rôle, including signalling systems, telephones, rock-dusting machines, heaters, drilling machines, etc.

CONCRETE

MORTAR TESTS. The Strength of Mortar and Concrete as Influenced by the Grading of the Sand, T. C. Powers. Pub. Roads, vol. 7, no. 8, Oct. 1926, pp. 174-176, 3 figs. Discusses paper published under same title in July issue of journal from point of view of fineness modulus theory and offers interpretation of data presented in original article, which author believes to be more in accord with fundamentals of concrete designing; he then presents statement of his belief as to what is really wrong with 1:3 mortar test.

CONCRETE CONSTRUCTION, REINFORCED

BUILDING. An Unusual Reinforced Concrete Structure. Concrete, vol. 21, no. 11, Nov. 1926, pp. 716-722, 7 figs. Example of constructional use of reinforced concrete in circumstances where structural steel would have been, if not impossible under circumstances prevailing, at any rate far more costly and difficult; building is now in course of erection in London for Cornwall Press; 250-ton point loads carried on 45-ft.-span beams.

HIGH-TENSION REINFORCEMENT. High-Tension Reinforcement, E. S. Andrews. Concrete, vol. 21, no. 11, Nov. 1926, pp. 723-726, 1 fig. Considers arguments in favour of allowing high-tension steel to be used for reinforced concrete and for permitting higher stresses to be employed in its design.

SLABS. Table of Dimensions for Solid Reinforced Concrete Slabs, J. F. Hurter. Concrete, vol. 21, no. 11, Nov. 1926, pp. 737-741, 1 fig. Presents table, purpose of which is to reduce to minimum work of calculation, as particularly preparation of estimates for public tenders entails considerable amount of non-productive work involving considerable expenditure of time; it should also be useful to architect in preparing designs, as it gives rapid information as to thickness of floor slabs.

COPPER

ROLLING AND HEAT TREATING. Copper and Brass Manufacture, W. R. Webster. Iron Age, vol. 118, no. 25, Dec. 16, 1926, pp. 1688-1690, 6 figs. Discussion of methods of rolling and heat-treating for producing non-ferrous wire sheets and other materials.

CONDENSERS, STEAM

PRACTICE AND PERFORMANCE. Steam Condenser Practice and Performance, E. J. Chatel. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 22 pp., 16 figs. Presents general idea of steam-condenser practice and performance in four plants of Detroit Edison Co.; condensers of single-pass type with range of from 0.95 to 1.05 sq. ft. of surface per kilowatt of turbine capacity should be considered good practice.

CONVEYORS

LUBRICATION. Problems in Lubricating Conveyors, F. E. Gooding. Indus. Engr., vol. 84, no. 11, Nov. 1926, pp. 513-517, 10 figs. Deals with types of equipment commonly used in industrial service.

MECHANICAL CONTROL. Its Almost Human, A. J. Howe. Factory, vol. 37, no. 6, Dec. 1926, pp. 998-1001, 1020 and 1024, 10 figs. Conveyor systems with mechanized control in footwear warehouse that minimizes cost of handling packages for storage and shipment.

COOLING TOWERS

FORCED-DRAUGHT. Testing Forced-Draught Cooling Towers, F. W. Rabe. Power, vol. 64, no. 23, Dec. 7, 1926, pp. 865-866, 1 fig. Rapid and simple method of telling whether cooling tower operating under one set of conditions meets guarantee made for another set of conditions.

COPPER ALLOYS

HOT FORGING. Effect of Hot Forging on Mechanical Properties of Alloys of Copper and of Aluminum (De l'influence du corroyage sur les propriétés mécaniques des alliages de cuivre et des alliages d'aluminium), M. Léon. Académie des Sciences—Comptes Rendus, vol. 183, no. 14, Oct. 4, 1926, pp. 541-544. Gives tables of impact and hardness tests before and after annealing of various types of brass, aluminum and alloys.

COPPER METALLURGY

HEAP LEACHING. Acceleration of Rate of Oxidation of Ferrous Iron in Presence of Copper, and Its Application to "Heap Leaching" Process, E. Posnjak. Am. Inst. Min. & Met. Engrs.—Trans., no. 1615-D, Dec. 1926, 10 pp., 2 figs. Extreme slowness of oxidation of acified ferrous solutions, as well as rapid increase in rate of oxidation with increasing concentration of ferrous iron are confirmed; it is shown that oxidation of ferrous sulphate by oxygen is greatly accelerated by presence of copper sulphate; discusses process of "heap leaching."

CORE BOXES

TYPES. Various Types of Core Boxes (Différents types de boîtes à noyaux), E. Esmoil. Fonderie Moderne, vol. 20, Nov. 1926, pp. 283-288, 17 figs. Discusses principle of design; choice of box in accordance with number of cores per box; dimensions, etc.; classification of boxes, with 15 examples.

CORES

BAKING. Comparative Costs of Core Baking in Gas-Fired vs. Coke-Fired Ovens, H. T. Odenkirk. Gas Age-Rec., vol. 58, no. 25, Dec. 18, 1926, pp. 371-372. Cost per ton reduced; breakage less, working conditions bettered with gas fuel.

CORROSION

IRON AND STEEL. Iron and Steel Sulphuric and Nitric Corrosion, S. C. Bate. Chem. Age, vol. 15, no. 383, Oct. 30, 1926, pp. 419-420. Results of experiments in which action of oleum, sulphuric acid and nitric acid of various concentrations and mixtures of these acids on iron and steel were compared with object of discovering relative powers of resistance of iron and steel towards these acids, and any limiting nitric acid or water content in mixed acids at which any considerable corrosion of metal surfaces can be said to begin.

CRANES

SLEWING. Dynamics of Moving Loads During Acceleration Period (Die dynamischen Vorgänge während der Beschleunigungsperiode bewegter Massen bei Drehkranen), J. M. Bernhard. Fördertechnik u. Frachtverkehr, vol. 19, nos. 21 and 22, Oct. 15 and 29, 1926, pp. 320-323 and 335-337, 7 figs. Discusses theoretical basis of moments of acceleration and inertia; work of acceleration, kinetic energy; develops formulas for 200-ton hammer head crane; diagrams on magnitude of resistances in operation from no load to maximum load.

CUPOLAS

COKE COMBUSTION. The Influence of Moisture on the Combustion, Especially of Coke (Ueber den Einfluss der Feuchtigkeit bei Verbrennungsvorgängen, insbesondere bei der Verbrennung von Koks), P. Oberhoffer and E. Piwowarsky. Stahl u. Eisen, vol. 46, no. 39, Sept. 30, 1926, pp. 1311-1320, 4 figs.

CUTTING TOOLS

HOLDERS. Methods of Holding Tools and Cutters, F. Horner. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 253-256, 5 figs. Tool-clamp requirements; cutters with clamping holes and slots; using special cross-section steel; welding and sweating tool bit to holders; simple holders employing binding screws; tool locating device.

CYLINDERS

LAPPING. Moline Automatic Cylinder Lapping Machine. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 305-306, 3 figs. Details of latest automobile-cylinder lapping machine developed by Moline Todd Co. with view to making operation as nearly automatic as possible.

MACHINING. Laying Out and Machining Large Pump Cylinders, W. Wheatley. Machy. (Lond.), vol. 29, no. 737, Nov. 25, 1926, pp. 246-247, 2 figs. Account of author's experience obtained while operating boring mill.

D

DIELECTRICS

PHASE DIFFERENCE. Phase Difference in Dielectrics, J. B. Whitehead. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1225-1228. Origins and causes of phase difference.

POWER-FACTOR MEASUREMENTS AND. Symposium of Dielectrics and Power-Factor Measurements. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1288-1297, 3 figs. Discussions of papers published in previous issues.

DIESEL ENGINES

BLOWERS FOR. Blowers for Marine Diesel Engines. Elecn., vol. 97, no. 2513, July 30, 1926, pp. 122-123, 5 figs. Electric motor and steam turbine-driven scavenging and supercharging sets; centrifugal vs. reciprocating blowers.

Generator Drive. High-Speed Diesel Engines for Driving Dynamos. Soc. Mech. Engrs. (Japan)—Jl., vol. 29, no. 114, Oct. 1926, pp. 595-617, 10 figs. Results of experiments on high-speed Diesel engine for driving dynamo at testing shop of Ikegai Iron Works, Ltd. (In Japanese.)

Maintenance. Hints on Diesel Engine Maintenance, J. M. Bloomfield. Power House, vol. 20, no. 22, Nov. 20, 1926, pp. 21-24. Author points out that many of parts which require care are common to all prime movers; cause of vibration; examination and cleaning of piston; condition of jackets; valves and fuel pump; inspection of governor.

Preheating Fuels for. Preheating Heavy Fuels for Diesel Engines. Oil Engine Power, vol. 4, no. 12, Dec. 1926, pp. 756-758, 3 figs. Tests demonstrate success in burning cheap heavy grades of oil.

600-B.Hp.. 600 -B.Hp. Four-Stroke Cycle Diesel Engine. Engineering, vol. 122, no. 3175, Nov. 19, 1926, pp. 626-628, 15 figs. partly on supp. plate. Six-cylinder engine with air injection, built by Belliss and Morcom.

DRILLING MACHINES

Boiler. Electrically-Operated Boiler Drill, O. Pollok. Eng. Progress, vol. 7, no. 11, Nov. 1926, pp. 303-304, 2 figs. Twin boiler-drilling machine for horizontal boilers supplied to Sulzer Bros., Switzerland, by Machinenfabrik Collet & Engelhardt, Germany; electrical equipment was supplied by German General Electric Co. (A.E.G.).

Radial. Locomotive Frame Radial Drilling Machine. Machy. (Lond.), vol. 29, no. 737, Nov. 25, 1926, p. 245, 2 figs. Details of Braun radial drilling machine; it is interesting in so far as it indicates trend of modern German design with regard to number and position of electric motors employed on single large machine and centralization of control gear.

DROP FORGINGS

Trimming. Dies and Presses for Trimming Forgings, E. V. Crane. Forging—Stamping—Heat Treating, vol. 12, no. 11, Nov. 1926, pp. 416-420, 8 figs. Discusses various types of dies and presses used for trimming drop forgings; data for selecting proper size press given.

E

ECONOMIZERS

Heat-Stage. Heat-Stage Economizers, W. S. Findlay. Power Engr., vol. 21, no. 248, Nov. 1926, pp. 405-406, 4 figs. Method of constructing economizers with two or three stages in order to efficiently apply contra-flow principle.

EDUCATION, INDUSTRIAL

Baltimore Plan. The Baltimore Plan of Industrial Education, E. B. Luce. Am. Gas Jl., vol. 124, nos. 6 and 23, Feb. 6 and June 5, 1926, pp. 109-112 and 493-497; and vol. 125, nos. 2 and 28, July 10 and Dec. 11, 1926, pp. 25-29 and 673-675, 5 figs. As developed and applied by Consolidated Gas, Elec. Light & Power Co. of Baltimore; types of education and training. July 10: "Training in" new employee. Dec. 11: Prize papers as means for developing employees.

Costs. The Costs of Engineering Education. Eng. Education—Jl., vol. 17, no. 3, Nov. 1926, pp. 300-314, 3 figs. Study to determine costs of engineering education as accurately as possible and express them in comparatively simple units, to determine sources from which engineering colleges derive their revenues, and purposes for which funds are expended, and relative amounts expended for different purposes.

ELECTRIC DISTRIBUTION

Progress. Transmission and Distribution, P. H. Thomas. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1207-1214. Annual Report of Committee on Power Transmission and Distribution.

ELECTRIC DISTRIBUTION SYSTEMS

Toronto Transportatiion Commission. Power Distribution Problems of the Toronto Transportation Commission, J. F. Neild. Eng. Jl., vol. 9, no. 12, Dec. 1926, pp. 504-509, 11 figs. Features of operation and maintenance affecting electrical department.

ELECTRIC GENERATORS

Waterwheel. Recent Improvements in Waterwheel Generators, R. Pruger. Power Plant Eng., vol. 30, no. 24, Dec. 15, 1926, pp. 1330-1331. Experience in operation of waterwheel generators has resulted in number of improvements, all of whieh add to reliability of machines.

ELECTRIC GENERATORS, A.C.

Design. Alternators of Large Modern Hydro-Electric Plants (Les alternateurs des grandes centrales hydrauliques modernes), H. dePistoye. Technique Moderne, vol. 18, no. 21, Nov. 1, 1926, pp. 641-650, 38 figs. Alternators coupled to turbines of horizontal and of vertical axis; design of rims, fixing poles on rims; induction coils; bearings; advantages and disadvantages of vertical axes, etc.

ELECTRIC LOCOMOTIVES

Classification and Analysis. Electric Locomotives, T. A. F. Stone. Engineering, vol. 122, no. 3176, Nov. 26, 1926, pp. 674-676, 2 figs. Method of classifying, analyzing and comparing their characteristics. (Abstract.) Paper read before Instn. Mech. Engrs.

ELECTRIC MOTORS

Classification and Analysis. Electric Locomotives, T. A. F. Stone. Engineer, vol. 142, no. 3698, Nov. 26, 1926, pp. 587-589, 2 figs. Method of classifying, analyzing and comparing their characteristics. Paper read before Inst. Mech. Eng.

ELECTRIC MOTORS, A.C.

Changing from 2- to 3-Phase. Changing Motors from Two- to Three-Phase Service, C. R. Sugg. Ry. Elec. Engr., vol. 17, no. 12, Dec. 1926, pp. 411-416, 6 figs. Showing methods of deriving formulas involved in making changes in strator windings.

Commutator. The Circle Diagrams of the Three-Phase Commutator Motor, A. H. M. Arnold. Instn. Elec. Engrs.—Jl., vol. 64, no. 359, Nov. 1926, pp. 1139-1151, 19 figs. Develops simplified mathematical theory of circle diagrams; outlines sources of error in theory and theoretical circles are then compared with test results; formulas are developed for slip, torque and mechanical power; phenomena occurring in operation of motor at synchronous speed with reference to effect of errors in brush settings.

Starting. Are Reduced-Voltage Starters Necessary on Alternating-Current Motors? T. H. Arnold. Power, vol. 64, no. 22, Nov. 30, 1926, pp. 809-811, 4 figs. Discusses across-the-line starter and experience given with this type on large number of motors ranging up to 500-h.p. capacity and for potentials up to 2,200 volts, supplied from generator capacity of 4,500 kw.

Star-Delta Starter for Induction Motors. Engineering, vol. 122, no. 3176, Nov. 26, 1926, pp. 656-657, 1 fig. Higgs Motors, Birmingham, Eng., produce cheap but reliable starter for use with other motors up to 10 h.p., but has no automatic release device and is about one-half cost of similar starters previously obtained.

Synchronous. Synchronizing Power in Synchronous Machines Under Steady and Transient Conditions, H. V. Putman. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1229-1237, 7 figs. Develops method by which synchronizing power may be calculated fairly accurately under any condition likely to be met with; method applies only to synchronous machines; of usual definite pole construction. Bibliography.

ELECTRIC POWER

Alberta. Electric Power Development in Alberta, H. J. Macleod. World Power, vol. 6, no. 36, Dec. 1926, pp. 285-291, 1 fig. Physical features of province; water-power and coal resources; hydro-electric and steam-electric power plants; uses of power.

ELECTRIC RAILWAYS

Interurban Cars. Indiana Service Corporation's New Cars Have Many De Luxe Features. Elec. Ry. Jl., vol. 68, no. 20, Nov. 13, 1926, pp. 874-879, 8 figs. Two parlor-chair buffet cars and five motor coaches with same general type of construction have ultra-comfortable seats; low-voltage lighting unaffected by varying line voltage; easy riding trucks and latest Pullman-car conveniences.

ELECTRIC TRANSMISSION LINES

Circle Diagram. The Circle Diagram of a Transmission Network, F. E. Terman. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1238-1245, 8 figs. Presents tables including formulas for determining coefficients of large number of circular loci which have not been heretofore constructed by mathematical methods; by establishing identity of Thielemans and Evans and Sels diagrams, it has been possible to utilize numerous geometrical properties of diagram that Thielemans has worked out, as well as to make use of other graphical properties.

Construction Organization. Economical Erecting Organization for Transmission Line Construction, F. H. Miller. Elec. World, vol. 88, no. 23, Dec. 4, 1926, pp. 1157-1160, 8 figs. Problems to be met in organizing construction crews; importance of public relations; factors affecting total cost of line.

Overhead Clearances. Factors in Overhead Line Clearances, W. C. Wagner. Elec. World, vol. 88, no. 22, Nov. 27, 1926, pp. 1115-1116, 7 figs. Results of comprehensive study of sag-span relations in design of aerial lines; fallacy of assuming change in sag increases indefinitely with increase in span demonstrated.

Sag and Stress. Sag and Stress Chart for Overhead Lines, C. H. Stubbings. World Power, vol. 6, no. 36, Dec. 1926, pp. 316-319, 1 fig. Presents table prepared for range of sizes of conductors under conditions of loading of Electricity Commissioners' Regulations, for both low- and high-tension circuits; chart was prepared for solid copper conductors.

Towers. Structural Features of a 459-ft., 220-kv. Double-Circuit Tranmission Tower, W. Dreyer. Jl. of Electricity, vol. 57, no. 10, Nov. 15, 1926, pp. 372-375, 2 figs. Details of low-anchor towers and high crossing towers; allowable stresses in members of towers; design features and foundations; physical data.

ELECTRIC WELDING, ARC

Characteristics and Application. Electric Welding, Characteristics and Uses (La soudure électrique), M. A. Ménétrier. Electricité & Mécanique, nos. 12 and 13, May-June and July-Aug. 1926, pp. 1-14 and 18-33, 26 figs. Concludes from experiments that for plates 2 to 30 mm. thick, arc welding is best; for thinner plates resistance welding is best; automatic arc welding as developed by G. E. C. and used in United States.

Hydrogen. Flames of Atomic Hydrogen, I. Langmuir. West. Soc. Engrs.—Jl., vol. 31, no. 10, Oct. 1926, pp. 373-387, 7 figs. Review of author's researches leading up to new development in welding.

Rails. Renewing Battered Rail Ends by Arc Welding, M. Whine and A. V. Thompson. Gen. Elec. Rev., vol. 29, no. 12, Dec. 1926, pp. 880-881, 3 figs. Results of tests by So. Pac. R. R. Co. making use of 2 gas-engine-driven sets.

Structural Steel. Tests of Arc Welded Structural Steel, A. M. Candy. Eng. Jl., vol. 9, no. 12. Dec. 1926, pp. 518-522, 15 figs. Test specimens were all welded with various members located in same position and manner as would be required if they were actually part of building structure.

Torches. The Electric Torch, J. C. Lincoln. Am. Welding Soc.—Jl., vol. 5, no. 11, Nov. 1926, pp. 18-23, 2 figs. Apparatus developed in laboratory of Lincoln Electric Co.; experiments indicate that core of arc is blast from negative terminal, that current flows outside of blast, and that section of current across arc would be annulus and not a circle.

ELECTRICITY, APPLICATIONS OF

Industry. General Power Application, A. M. MacCutcheon. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1277-1284. Annual report of committee, dealing with applications of electricity to rubber mills, bakeries, petroleum industry, irrigation, chemical and electrochemical plants, paper mills, steel mills, railways, etc.; advances in electric furnaces, elevators, arc welding, control, foreign developments. Bibliography.

Mines. Electricity in Mine Work, F. L. Stone. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, p. 1285. Annual report of committee.

ELECTROMAGNETS

Properties and Design. Properties and Design of Electromagnets, F. J. Dommerque. Telephone Engr., vol. 30, no. 11, Nov. 1926, pp. 21-25, 13 figs. Magnetizing curves; magnet cores; magnetic circuit; winding and heating of electromagnets.

ELECTROPLATING

Mechanical. Mechanical Electro-Plating of Metal, W. S. Barrows. Can. Foundryman, vol. 17, no. 11, Nov. 1926, pp. 5-7 and 30, 3 figs. Review of development; due to remarkable improvements made in construction and design of machine, 1926 models resemble original model only in principle involved.

ELEVATORS

Controllers. Direct-Current Elevator Controllers, C. A. Armstrong. Power, vol. 64, no. 23, Dec. 7, 1926, pp. 861-864, 3 figs. Operation of two-speed full-magnet type.

Gearless-Traction. The Emergency Stops of the Gearless-Traction Elevator at the Terminal Landings, F. Hymans. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 69 pp., 21 figs. Performance and limitation of emergency terminal stopping devices; calculation of required overhead clearances.

Practice. Electric Elevator Practice, E. M. Bouton. Elec. Jl., vol. 23, nos. 2, 3, 4, 5, 6, 8, 9 and 11, Feb., Mar., Apr., May, June, Aug., Sept. and Nov. 1926, pp. 52-57, 125-130, 156-161, 253-258, 322-325, 432-434, 470-475 and 572-579, 50 figs. Feb.: Classification; power requirements. Mar.: Slow- and medium-speed elevators. Apr.: High-speed passenger elevators. May: Controllers for high-speed elevators. June: D.C. elevator motors. Aug.: Signals and dispatching systems. Sept.: Installation tests and maintenance of electrical apparatus. Nov.: Testing of elevator equipments.

EMPLOYMENT MANAGEMENT

EMPLOYERS' RESPONSIBILITY. The Employer: His Responsibilities, C. Piez. Engrs. & Eng., vol. 43, no. 10, Oct. 16, 1926, pp. 262-263. Points out that in final analysis, employer's responsibility consists of finding market in which he can dispose of labour of his workers; wages cannot be considered separately from production.

ENGINEERING

CIVIL. The Civil Engineer in Industry. Eng. News-Rec., vol. 97, nos. 16, 18, 21 and 24, Oct. 14, 28, Nov. 18 and Dec. 9, 1926, pp. 612-616, 710-712, 824-828 and 956-958, 6 figs. Results of study in field of civil engineering. Oct. 14: Plant engineering. Oct. 28: Executive engineering. Nov. 18: Industrial staff engineers and constructors. Dec. 9: Industrial municipal engineers.

ECONOMICS AS RELATED TO. Relation of Science of Economics to Engineering, L. W. McIntyre. Professional Engr., vol. 2, no. 11, Nov. 1926, pp. 5-8. Definition of engineering; author maintains that knowledge of economics and political economy is necessary to enable engineer to properly solve practically all routine problems of his every-day practice.

EXPLOSIVES

STORAGE. Storing Commercial Explosives, E. B. Jones. Eng. & Min. Jl., vol. 122, no. 21, Nov. 20, 1926, pp. 804-809, 7 figs. Selecting site for magazine; design and materials to be used in building; ventilation; proofing against weather and fire.

F

FILTERS, SAND

HEAD-LOSS DETERMINATION. Determining Pressure and Permeability of Sand in Filters. Water Works, vol. 65, no. 11, Nov. 1926, pp. 533-535, 2 figs. Special apparatus to determine head losses in rapid sand filters at Cambridge, Mass., under operating conditions.

FILTRATION PLANTS

ECONOMICAL CAPACITY. The Economical Capacity of Filters and Filtered Water Storage, A. B. Morrill. Am. Water Wks. Assn.—Jl., vol. 16, no. 5, Nov. 1926, pp. 582-592, 1 fig. Diagram of filter and reservoir ratios; effect of storage on required filter capacity; economical filter and reservoir sizes; study shows that additional filtered water storage is not as valuable as was at first expected; economical filter ratio is shown to be about 1.35.

FIRE PREVENTION

METHODS. The Prevention and Extinction of Fires. Chem. Age, vol. 15, no. 383, Oct. 30, 1926, pp. 418-419. Résumé of methods and materials used in prevention and extinction of fires in chemical industry.

FLAME PROPAGATION

CLOSED CYLINDERS. An Investigation of the Mechanism of Explosive Reactions. Uni. of Illinois Bld., vol. 23, no. 46, July 20, 1926, pp. 7-49, 19 figs. Study of flame propagation in closed cylindrical bomb and comparison of results of theoretical analysis of flame propagation with actual phenomena as observed by means of photographic records; study of explosion of mixtures of ethyl ether and air in cylindrical bomb of constant volume. Bibliography.

Flame Propagation in Closed Cylinders, G. R. McCormick. Sibley Jl. of Eng., vol. 40, no. 8, Nov. 1926, pp. 138-146 and 155-156, 16 figs. It has been noted by number of experimenters that in case of flame propagation in closed vessels there seems to occur a halt in velocity of flame propagation after wave front has travelled about two-thirds of length of vessel; phenomenon has been termed flame arrest; effects of variation in mixture ratio and of variations in dimension of domb upon flame arrest.

FLOW OF AIR

PRESSURE DISTRIBUTION. Influence of the Orifice on Measured Pressures, P. E. Hemke. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 250, Nov. 1926, 7 pp., 10 figs. Influence of different orifices on result of measuring same pressure distributions; circular cylinder is exposed to air stream perpendicular to its axis and its pressure distribution is repeatedly determined.

FLOW OF WATER

CURVED PIPES. Velocity at Tangent of Curves of 36-in. Pipe, T. F. Davey. Eng. News-Rec., vol. 97, no. 23, Dec. 2, 1926, p. 905, 2 figs. Presents curves which are results of test carried out on 36-in. reservoir discharge pipes under head of 80 ft. at point of tangency of two curves, one the reverse of other; purpose was to establish supposition that on bend coefficient remained unchanged at different discharge rates.

FOREMEN

SCIENCE OF FOREMANSHIP. The Science of Foremanship, B. H. Van Oot. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1404-1406. Rapid development of foremanship into science; primary essentials of good foremanship; science of foremanship inclusive of science of management, supervision and teaching; foremanship science of leadership.

FORGING

PRESSES. A Novel Electrically-Operated Forging Press, A. Friederici. Eng. Progress, vol. 7, no. 11, Nov. 1926, pp. 309-311, 4 figs. Details of press manufactured by Kalk Machine Works, and comparison of this type with forging hammers and presses hitherto used.

FORGINGS

BRASS. Brass Forgings, O. J. Berger. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 299-300. Gives reasons for forgings replacing brass castings; finish and strength of forgings; comparison of machine costs; hot-pressed parts; dies for hot-pressed parts; drop and steam hammers and for trimming flash; importance of correct heating.

FOUNDATIONS

BUILDING. Foundations in the Winnipeg District, A. W. Fosness. Eng. Jl., vol. 9, no. 12, Dec. 1926, pp. 495-503, 2 figs. Outline of conditions, describes experience of various works and compares types of foundations and costs.

FREIGHT HANDLING

CONTAINER SYSTEM. Scientific Transportation, W. P. Kellett. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 563-568, 2 figs. As means of reducing number of handlings of freight necessary by present methods, use of container system is receiving increased attention; among salient features that such a system should possess are simplicity, ability to load and unload with ease; capacity for transferring containers quickly and easily from car to truck chassis without use of special equipment, and sturdiness and strength to withstand shocks; describes such system.

FUEL ECONOMY

CANADA. Fuel Problem in Canada, L. R. Thomson. Can. Ry. Club—Official Proc., vol. 25, no. 7, Oct. 1926, pp. 21-50, 8 figs. Deals with actual situation in Canada in regard to location of coal, centre of gravity of consumption, size of markets in fixing selling price, magnitude of imports and consumption and other similar factors; certain aspects of Canadian mining in relation to mining elsewhere.

FUELS

AUTOMOTIVE. *See Automotive Fuels.*
COAL. *See Coal; Pulverized Coal.*
PULVERIZED COAL. *See Pulverized Coal.*

FURNACES, HEAT-TREATING

ROTARY-RETORT. Heat-Treatment of Conveyor Parts in Rotary-Retort Furnaces, F. S. O'Neill. Fuels and Furnaces, vol. 4, no. 12, Dec. 1926, pp. 1451-1452 and 1468, 2 figs. Rotary-retort furnaces heated with by-product coke-oven gas used in annealing, hardening and carburizing of parts of various sizes.

FURNACES, HEATING

GAS-FIRED. Town Gas-Fired Plate and Bar Re-Heating Furnace. Gas Jl., vol. 176, no. 3311, Nov. 3, 1926, pp. 290, 2 figs. Believed to be the largest furnace in England fired by means of city gas; advantages derived from utilization of city gas when properly applied.

G

GAS ENGINES

CYCLES. Ideal Gas-Engine Cycles, R. C. Heck. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 41 pp., 23 figs. Author's purpose is to promote use, with internal-combustion engine of ideal performance as standard of comparison, by making standard almost as readily convenient as is Mollier chart for steam engine; this purpose is accomplished in two steps: developing working chart that combines in one temperature-entropy diagram and diagram of internal energy and total heat on entropy, in which any horizontal line is line of constant temperature, constant energy and constant total heat; and showing by trial upon representative examples that this chart, based on properties of average gas mixture, gives essentially correct output for any working mixture within range of gas-engine practice.

GAS MANUFACTURE

CONTINUOUS PROCESS. A Revolutionary Improvement in Gas Manufacture, C. J. Ramsburg. Gas Age-Rec., vol. 58, no. 25, Dec. 18, 1926, pp. 865-870 and 872, 6 figs. Continuous process for manufacture of blue gas or carburetted water gas; development and success of automatic charger and self-clinkering generator base.

GEAR CUTTING

SECTORS. Radius Milling Fixture for Gear Sector, A. A. Dowd. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, p. 274, 2 figs. Fixture consists of base secured to milling-machine table, dovetail slide on which work is clamped and radius bar, outer end of which pivots on stud on bracket, which is secured to knee.

GEARS

NON-METALLIC. Using Non-Metallic Gear Drives, F. E. Gooding. Indus. Engr., vol. 84, no. 12, Dec. 1926, pp. 549-553 and 574, 10 figs. Prevention of noise and reduction of gear wear by eliminating metal-to-metal contacts; use of rawhide pinions and chemically prepared, non-metallic gear materials which consist of layers of fabric impregnated with and incorporated in, under heat and pressure, body of Bakelite phenol resinoid; another method of making fabric-base gear material is by use of impregnated cotton fibre.

SYMBOLS. A.G.M.A. Symbols for Gearing. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, p. 263. Gives list of standard symbols for gearing nomenclature, suggested by Am. Gear Mfrs'. Assn.

TEETH IN ACTION. Gear Teeth in Action, E. Buckingham. Am. Mach., vol. 65, nos. 17, 18, 20, 21, 22, 23, 24 and 25, Oct. 21, 28, Nov. 11, 18, 25, Dec. 2, 9 and 16, 1926, pp. 677-679, 709-712, 787-790, 821-824, 863-866, 901-907, 946 and 993-995, 29 figs.

WORM. Worm-Wheel Contact, E. Buckingham. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 28 pp., 20 figs. Shows how any worm-wheel contact condition can be determined by analysis and points out in particular probable influence of nature of contact lines between worm and worm-wheel upon lubrication conditions, efficiency and load-carrying ability; analyses of three helicoids are made and their equations given; conjugate action of racks is discussed and equations given; contact lines of screw helicoids used as worms and those of involute helicoids used as worms.

GOLD MINES

CANADA. The Gold Industry in Canada—1925. Can. Min. Jl., vol. 47, nos. 48 and 49, Nov. 26 and Dec. 3, 1926, pp. 1128-1130 and 1150-1151. Among Canada's mineral products, gold holds second place in point of value, being surpassed only by coal; Ontario mines; British Columbia, Yukon, Prairie Provinces, Quebec, Nova Scotia; alluvial gold-mining, auriferous quartz mining, and copper-gold-silver mining industry.

GRINDING

EXTERNAL. External Cylindrical Grinding (Rectification cylindrique extérieure), M. Guénard. Arts et Métiers, vol. 79, nos. 69, 70 and 73, June, July and Oct. 1926, pp. 201-218, 262-271 and 361-375, 40 figs. Operating conditions of grinding wheels, arc of contact, depth of cut, performance and wear; longitudinal displacement of workpiece or of grinding wheel. July: Speed of grinding wheel and of workpiece; preparing workpiece for grinding. Oct.: Time study; internal grinding; wet and dry grinding; examples.

GRINDING MACHINES

STEEL BALLS. Progress in Abrasive Invention. Abrasive Industry, vol. 7, no. 12, Dec. 1926, pp. 381-382, 6 figs. Details of device for accurate grinding of steel balls, devised by Basile Francois Mahe.

H

HARDNESS

FIRTH HARDOMETER. The Firth Hardometer. Foundry Trade Jl., vol. 34, no. 536, Nov. 25, 1926, p. 459, 2 figs. Apparatus has advantage of eliminating effect of inertia when applying load, and thus rules out that very considerable course of error to which many machines of this type are prone; there has been incorporated for use with hardometer diamond indenters which can be used in this machine by merely changing ball for such indenter.

HEAT TRANSMISSION

HIGH TEMPERATURES. Fluid Heat Transmission for High Temperatures in Industrial Processes, J. A. Beavell. Chem. & Industry, vol. 45, no. 45, Nov. 5, 1926, pp. 367T-376T, 21 figs. Oil may be regarded as entirely satisfactory for heat transmission at high temperatures, and failure to apply it successfully has been largely due to want of proper understanding of numerous factors involved and lack of attention to detail; details of oil-circulation heating system which has been applied to very large number of industrial processes and proved entirely satisfactory and reliable.

HEATING, HOUSE

Oil Fuel. Domestic Heating with Oil Fuel, R. W. Caldwell. Can. Engr., vol. 51, no. 21, Nov. 23, 1926, pp. 653-654. Abstracts from symposium on heating residences, presented before Ontario Section of Am. Soc. Mech. Engrs.

HEATING AND VENTILATION

Telephone Building, New York City. Zone Heating and Ventilating Systems Used in New Telephone Building. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 12, Dec. 1926, pp. 807-816, 9 figs. Because of nature of occupancy and demand for maximum of comfort for employees, system of heating and ventilation which might be termed sectional or zone type was designed.

HIGHWAYS

Research. Technical and Statistical Problems Under Study by Highway Research Board. Eng. News-Rec., vol. 97, no. 24, Dec. 9, 1926, pp. 959-961. Sixth annual meeting pictures extensive activities; pavement and sub-grade as well as volume and safety of traffic are principal subjects of investigations; current practice surveyed.

HOBBING MACHINES

Change-Gears for. Change-Gears for Spiral Gear Hobbing, J. M. Christman. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 272-274. Table for rapid computation of change gears and example illustrating application; method outlined may be used in computing change-gears that produce exceptionally accurate leads.

Helical Gears. Unusual Example of Helical Gear Hobbing. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, p. 301, 1 fig. Describes hobbing helical pinion of No. 5 Newark gear-hobbing machine having differential so that roughing and finishing cuts were taken readily, as gear trains were not disengaged when carriage was returned for finishing cut.

HYDRAULIC TURBINES

Draught Tubes. Draught Tubes for Turbines (Ueber Turbinensaugrohre), H. Baudisch. Dinglers Polytechnisches Jl., vol. 107, no. 15, Aug. 1926, pp. 165-167, 2 figs. Operation and calculation of draught tubes for turbines with dynamic and with static power transmission.

Eddy-Impulse. The Eddy-Impulse Turbine (Die Wirbelstrahlturbine), A. Gratzl. Zeit. des Osterr. Ingenieur- u. Architekten-Vereines, vol. 78, no. 43/44, Oct. 29, 1926, pp. 429-433, 7 figs. New impulses turbines with especially high absorption capacity and high specific r.p.m., developed at laboratory of Vienna Technical High School; this type was designed as compromise between impulse and Francis types.

HYDRAULICS

Progress in. Progress in Hydraulics. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1417-1419. Progress report contributed by Hydraulic Division of Am. Soc. Mech. Engrs. dealing with water control, penstocks, turbines, automatic plants, impulse wheels, governors and oil sets and valves.

HYDRO-ELECTRIC DEVELOPMENTS

Quebec. Power Development at St. Narcisse, Que. Can. Engr., vol. 51, no. 22, Nov. 30, 1926, pp. 665-666, 3 figs. North Shore Power Co., subsidiary of Shawinigan Water & Power Co., build dam above Grand Chute and power house below Chute Platte on Batiscan River; two 11,200-h.p. Morris turbines and 10,000-kva. Westinghouse generators installed.

St. Lawrence River. Report on St. Lawrence River Power Project. Can. Engr., vol. 51, no. 22, Nov. 30, 1926, pp. 667-670. Canadian section of Joint Engineering Board recommends two-stage development at Ogden Island and Long Sault, while American section advocates single-stage development at Barnhart Island; two-stage would give 2,619,000-h.p. and one-stage 2,730,000-h.p. See also Contract Record, vol. 40, no. 48, Dec. 1, 1926, pp. 1132-1135, 1 fig; and Eng. News-Rec., vol. 97, no. 23, Dec. 2, 1926, pp. 906-911.

HYDRO-ELECTRIC PLANTS

Intakes. Water-Intake Designed for Wide Distribution of Flow, M. G. Salzman. Eng. News-Rec., vol. 97, no. 25, Dec. 16, 1926, pp. 998-1002, 6 figs. Johnson-Wahlman draught distributor draws from wide area without unduly affecting flow; typical installation in Canada.

Quebec. Developing 400,000 H.P. for World's Largest Paper Maker, R. C. Rowe. Power House, vol. 20, no. 21, Nov. 5, 1926, pp. 19-24, 9 figs. Power developments of Canadian International Paper Co. which is capable of furnishing initial output of 400,000 h.p.

22,000-H.P. Hydro-Electric Plant on the Batiscan River. Contract Rec., vol. 40, no. 47, Nov. 24, 1926, pp. 1110-112, 8 figs. Development consists of comparatively low dam above Grande Chute; power house in gorge near foot of rapids below Chute Platte, and 13-ft. diameter tunnel which connects intake and power house, about 4,000 ft. apart; details of impounding dam; power house contains two 11,200-h.p. I. P. Morris turbines driving 10,000-kva., 6,600-volt, 3-phase, 60-cycle Westinghouse generators; turbines are Francis type.

I

ICE PLANTS

Water Purification. The Raw Material of the Ice Plant—Water, A. S. Behrman. Refrig. Eng., vol. 13, no. 3, Sept. 1926, pp. 92-95. Common impurities in water; recent developments in water purification for raw-water ice; when to use alum treatment and equipment required.

INDUSTRIAL MANAGEMENT

Developments. Progress in Management Engineering. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1407-1409. Progress report on review of recent accomplishment prepared by Management Division of Am. Soc. Mech. Engrs.

INSPECTION

Method. Modern Developments in Inspection Methods, E. D. Hall. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1435-1443, 21 figs. Description of ingenious apparatus and unique methods by means of which inspection keeps pace with production at Hawthorne Plant of Western Electric Co.

INSULATION, ELECTRIC

Line Control. Controlling Insulation Difficulties in the Vicinity of Great Salt Lake, B. F. Howard. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1268-1272, 5 figs. Deals with difficulties encountered in maintaining sufficiently high degree of line insulation on long communication circuits; object of studies was to ascertain variations in line insulation caused by different weather and temperature conditions.

INSULATION, HEAT

Dwellings. Insulation of a Private House, L. Nusbaum. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 12, Dec. 1926, pp. 793-798, 3 figs. In 1922 author built two-storey and attic colonial house, and insulated all exterior walls and exposed ceilings with 1½-in. thick corkboard; results obtained by use of cork-insulated house, including saving in fuel, greater comfort at lower temperatures, more uniform temperatures between floor and ceiling, freedom from draughts and greater comfort in summer.

INTERNAL-COMBUSTION ENGINES

Detonation. The Role of Metallic Colloids in the Suppression of Detonation, H. L. Olin, C. D. Read and A. W. Goos. Indus. & Eng. Chem., vol. 18, no. 12, Dec. 1926, pp. 1316-1318, 4 figs. Investigation involving comparison of knock-producing tendencies of three classes of liquid fuels: (1) gasolines in which was dissolved measured quantity of anti-knock and small quantity of raw rubber; (2) gasoline in which was suspended metal colloid equivalent to solution (1) stabilized with small percentage of raw rubber; (3) pure gasoline except for same concentrations of rubber as other two, added for control; motor used was Harley-Davidson twin-cylinder, motor-cycle engine.

High Compression Without Anti-Detonators. High Compression in Explosion Engines (Le surcompression dans les moteurs à explosion), P. Dumanois. Technique Moderne, vol. 18. no. 22, Nov. 15, 1926, pp. 673-679, 5 figs. Detonation problems; anti-knock compounds, their composition and use; eliminating detonation without using anti-knock compounds by modifying shape of combustion chamber.

Supercharging. Supercharging Explosion Engines (La suralimentation dans les moteurs à explosion), L. Picard. Nature, no. 2743, Oct. 30, 1926, pp. 285-288, 9 figs. Advantages and disadvantages of supercharging; horse power developed with and without compressor; different types of compressors; kinematic principle of Cozette compressor, etc.

See also Automobile Engines; Diesel Engines; Gas Engines; Oil Engines.

IRON

Plastic Deformation. The Plastic Deformation of Iron. Metallurgist (Supp. to Engineer, vol. 142, no. 3698), Nov. 26, 1926, pp. 161-162. Discusses formation of slip bands under strain; results of research.

IRON ALLOYS

Chromium-Iron-Carbon. Nature of the Chromium-Iron-Carbon Diagram, M. A. Grossman. Am. Inst. Min. & Met. Engrs.—Trans., no. 1612-C, Dec. 1926, 17 pp., 18 figs. Consideration of somewhat radical modifications in iron-carbon diagram which are result of presence of notable amounts of alloying elements.

Iron-Molybdenum. The Iron-Molybdenum System, W. P. Sykes. Am. Soc. Steel Treat.—Trans., vol. 10, no. 6, Dec. 1926, pp. 839-870 and (discussion) 870-871 and 1035, 46 figs. Describes carbon-free alloys of iron and molybdenum and includes equilibrium diagram of this system as determined from fusion temperatures, heat treatments and study of accompanying microstructures; temperature-solubility relations make possible development of secondary hardness by aging supersaturated solid solution at 1,112 to 1,292 deg. Fahr.; this hardness is equal to that of high-speed steel and persists at temperatures considerably higher.

IRON CASTINGS

Improvement. Results in Improving Quality of Iron Castings (Etude comparative des résultats obtenus dans l'amélioration des qualités des fontes moulées), L. Piedbeuf. Revue Universelle des Mines, vol. 12, no. 1, Oct. 1, 1926, pp. 2-11, 5 figs. Compares various kinds of cast iron of high resistance by means of Maurer diagram; effect of rapid and slow cooling; graphitization; micrographic study.

Tinning. Some Notes on Tinning Iron Castings, A. Eyles. Mech. World, vol. 80, no. 2079, Nov. 5, 1926, p. 360. Dilute sulphuric-acid bath is sometimes used as pickling solution for iron castings; preparation of hydrofluoric-acid pickling solution; pure tin should be used if it is necessary to obtain bright lustre.

IRON METALLURGY

Progress. The New Year's Progress in Ferrous Metallurgy. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1443-1448, 3 figs. Presents advances in metallurgy of ferrous materials that have taken place since summer of 1925; deals with martensite, delta iron, impact tests on nickel-chromium steels, macroscopic examination of iron and steel, etching reagents, ultra-violet metallurgy, X-ray photography, chronizing, method of observing flaws in metal surfaces, dilatometric method of heat treatment, carbonization, Maurier carbon-silicon diagram of cast iron, malleable cast iron, electric silicon steel, fatigue failure of metals, etc.

J

JIGS

Design. Points on Jig and Fixture Design, C. C. Hermann. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 250-252, 4 figs. Finish on jigs; planning sequence of operations; milling fixture; drill jig for second operation.

K

KILNS

Cement Mills. Power Plant and Kiln Design and Operation, R. R. Coghlan and T. H. Arnold. Concrete (Mill Section), vol. 29, nos. 4, 5 and 6, Oct., Nov. and Dec. 1926, pp. 103-107, 99-103 and 97-100 and 107, 14 figs. Design and operation of power plants and kilns in cement plants; mechanical features and their inter-relation and dependence on each other. Oct.: Waste-heat boilers. Nov.: Flues and other gas passages. Dec.; Instruments and methods of control.

L

LATHES

Turret. Machining Hoist Drums in Turret Lathes. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 279-280, 4 figs. Two turret lathe set-ups used in plant building excavating, concrete-conveying and other construction machinery.

Warner & Swasey Universal Turret Lathe. Machy. (N.Y.), vol. 33, no. 4, Dec. 1926, pp. 312-313, 3 figs. No. 4 lathe having bar capacity of 1½-in. and maximum swing over ways is 16 in. See also Iron Age, vol. 118, no. 23, Dec. 2, 1926, pp. 1552-1553, 3 figs.

LIGHTING

Street. Glare of Street Lamps and Its Influence Upon Vision, L. L. Holladay. Illum. Eng. Soc.—Trans., vol. 21, no. 9, Nov. 1926, pp. 960-981, 13 figs. Investigation to determine, if possible, what should be arrangement of street-lighting units and how their light should be distributed in order to secure maximum of useful illumination with minimum of glare.

LIGHTNING

Rods and Cages. Lightning, F. W. Peek, Jr. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1246-1254, 11 figs. Study of lightning rods and cages, with special reference to protection of oil tanks.

LOCOMOTIVES

Electric. *See Electric Locomotives.*

Mikado. Mikado Locomotives for the Canadian National. Ry. Rev., vol. 79, no. 20, Nov. 13, 1926, pp. 707-708, 2 figs. Built in Pt. St. Charles shops for freight service in Atlantic region; boiler is equipped with siphons and feed-water heaters.

STEAM-TURBINE. A New Ljungström Turbo-Condensing Locomotive. Ry. Gaz., vol. 45, no. 18, Oct. 29, 1926, pp. 516-517, 3 figs. Built for service on British railways and under test on London, Midland & Scottish Railway; it consists of boiler-carrying vehicle and turbine-driven condenser vehicle, latter having three pairs of coupled and driving wheels.

LUBRICATORS

SIGHT-FEED. Positive Sight-Feed Oiler for New Design. Oil Engine Power, vol. 4, no. 12, Dec. 1926, pp. 759-760, 2 figs. Visibility of discharged oil, independent removal of pump units, are features.

PRACTICE, PROGRESS IN. Progress in Machine-Shop Practice. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1424-1425. Progress report contributed by Machine-Shop Practice Division of Am. Soc. Mech. Engrs.

M

MACHINE TOOLS

ALIGNMENT. Alignment in Machine Tool Practice, F. Horner. Engineering, vol. 122, nos. 3175 and 3176, Nov. 19 and 26, 1926, pp. 647-648 and 676-677, 20 figs. Points out that any inaccuracy in regard to alignment affects product in some way or other, and adds to difficulty of setting up and of operation; deals with question of main frame or bed as primary matter concerning alignment.

LIGHT CASTINGS FOR. Lighter Metal for Machine Tools, J. W. Bolton. Iron Age, vol. 118, no. 24, Dec. 9, 1926, pp. 1615-1618, 5 figs. Discusses what can be done to help quality of tool by raising physical standards of casting; advocates use of steel and alloy steel; suggests that use of fine-grained iron of nearly pearlitic matrix is ideal material for machine-tool construction.

SELECTION. What Are the Steps Taken in Buying Equipment? Am. Mach., vol. 65, no. 24, Dec. 9, 1926, pp. 935-936. Answers to questionnaire giving views of various organizations.

MAGNETIC FIELD

DYNAMO-ELECTRIC MACHINE. The Magnetic Field of the Dynamo-Electric Machine, F. W. Carter. Instn. Elec. Engrs.—Jl., vol. 64, no. 359, Nov. 1926, pp. 1115-1138, 49 figs. Deals with reluctance of magnetic circuit, particularly of air gap and teeth; slots in which conductors carrying currents are located; distributed excitation and reaction of load on exciting field; reactance of imbedded conductors; details of calculations.

MALLEABLE CASTINGS

ANNEALING. Annealing Malleable Castings in a Continuous Tunnel Furnace, W. N. Robinson. Fuels and Furnaces, vol. 4, no. 12, Dec. 1926, pp. 1473-1475 and 1478, 3 figs. Semi-muffle furnace of tunnel-kiln type heated by producer gas has productive capacity of 16 tons per 24-hour day on 120-hour annealing cycle.

GRAPHITIZATION. On the Malleable Cast Iron and the Mechanism of Its Graphitization, T. Kikuta. Foundry Trade Jl., vol. 34, nos. 534, 536 and 537, Nov. 11, 25 and Dec. 2, 1926, pp. 409-412, 464-466 and 477-479, 14 figs.

HEAT TREATMENT. The Malleabilizing Heat Treatment, H. A. Schwartz. Forging—Stamping—Heat Treating, vol. 12, no. 11, Nov. 1926, pp. 413-415. Author discusses metallurgical and manufacturing limitations under which heat treatment of malleable castings is carried out.

WHITE-HEART VS. BLACK-HEART. A Comparison of White-Heart and Black-Heart Malleable Cast Irons, A. E. Peace. Foundry Trade Jl., vol. 34, no. 536, Nov. 25, 1926, pp. 460-462. Essential difference in two materials is due to pig iron used; melting and casting; annealing and straightening; structure and physical properties; magnetic properties; applications.

MALLEABLE IRON

MALLEABLEIZING KILN. A Continuous Malleableizing Kiln, G. Blakney. Am. Gas Assn. Monthly, vol. 8, no. 12, Dec. 1926, pp. 755-756 and 759-760. Development of tunnel type of continuous oven, through which pots of castings are passed in regular sequence; outstanding feature is design of tunnel, which is open full length on both sides from bottom of kiln; another characteristic is semi-muffle feature.

MATERIALS HANDLING

PROGRESS IN. Progress in Materials Handling. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1409-1410. Progress report prepared by Materials Handling Division of Am. Soc. Mech. Engrs.

METAL DRAWING

PLASTIC BEHAVIOUR OF METAL. The Plastic Pehaviour of Metal in Drawing, C. L. Eksergian. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 35 pp., 21 figs. Author seeks to foster development of analysis to drawing as aid to subsequent development; outlines manner of working metal with reference to its state and behaviour in comparison with that found in drawing; survey of conditions observed in forming of stamping.

METALS

HARDENING. The Hardening of Metals by Dispersed Constituents Precipitated from Solid Solutions, R. S. Archer. Am. Soc. Steel Treating—Trans., vol. 10, no. 5. Nov. 1926, pp. 718-747 and (discussion) 747-757, 9 figs. Metals may be effectively hardened by highly dispersed particles within grains; typical process of hardening by this means consists in solution heat treatment at relatively high temperature followed by rapid cooling into region of supersaturation, then by precipitation treatment or aging to permit formation of very fine precipitate; examples of this type of hardening and generalizations regarding theory of process.

PLASTIC BEHAVIOUR OF METAL. The Plastic Behaviour of Metal in Drawing, C. L. pp., 20 figs. Nature and results of plastic deformation produced in cold working of metals; plastic deformation in face-centred cubic metal takes place by slip; many processes involved in cold working of metal give rise to same effects as those which occur by simple processes of elongation and directional rolling.

MICA

MINING AND MILLING. Mica Mining and Milling Methods, T. Antisell. Eng. & Min. Jl., vol. 122, no. 23, Dec. 4, 1926, pp. 894-896, 1 fig. Crushing, washing, screening and drying in North Carolina producing properties.

MILLING MACHINES

RAPID-PRODUCTION. Rapid-Production Milling Methods Applied to Tractor Parts, F. B. Heitkamp. Automotive Industries, vol. 55, no. 23, Dec. 2, 1926, pp. 932-937, 24 figs. Installation of modern machines and special fixtures enables manufacturer to effect savings in labour, floor space and time; standard cutters and arbors used; operations are described.

MINE TIMBERING

TIMBER SUPPLY. Future Timber Supply for Coal Mines, L. D. Tracy. U. S. Bur. Mines—Reports of Investigation, no. 2784, Nov. 1926, 5 pp. Reforestation programme; organization of forestry work; artificial propagation of hemlock trees; systematic cutting; methods of utilizing timber; description of mill; use of waste lumber.

MINERAL DEPOSITS

MANITOBA. Manitoba: A Potential Canadian Mining Area, H. P. Prather. Eng. & Min. Jl., vol. 122, no. 23, Dec. 4, 1926, pp. 887-893, 4 figs. Geological exploration began about 1873; gold and copper predominant economic minerals.

MOULDS

FUNCTION AND PREPARATION. The Mould—Its Function and Preparation, J. E. Fletcher. Foundry Trade Jl., vol. 34, no. 533, Nov. 4, 1926, pp. 389-392, 1 fig., and discussion in no. 534, Nov. 11, 1926, pp. 413-415. Effect of hot moulds; ingot manufacture; Harmet process of making steel ingots in thick iron water-cooled moulds; ingots being kept in contact with mould by means of hydraulic ram; types of moulds; sand mould and sand testing; standardization difficulties.

SCABS. Various Causes of Scabs. Foundry Trade Jl., vol. 34, no. 536, Nov. 25, 1926, pp. 453-454, 3 figs. Critical discussion of article by H. S. Newton, published Aug. 19 issue of same journal.

MOTOR-BUS TRANSPORTATION

CITIES. The Motor Coach in City Transportation, W. A. Draper. Aera, vol. 16, no. 5, Dec. 1926, pp. 807-812, 2 figs. Experience of Cincinnati Street Railway Co. is that bus lines did not draw from street cars when they were extended into territory that actually needed additional service.

N

NICKEL PLATING

BATH. The Control of Acidity in the Nickel-Plating Bath, W. A. Taylor. Can. Chem. & Met., vol. 10, no. 11, Nov. 1926, pp. 261-262, 2 figs. For nickel-plating under usual condition in still tanks, best pH is generally from 5.6 to 5.8; with higher pH (lower acidity) deposits are softer and may be dull or burnt; with lower pH (higher acidity) deposits are harder and brighter, but more brittle; method of making measurements; how to adjust acidity.

NICKEL STEEL

PHYSICAL PROPERTIES. Physical Properties of Nickel and Nickel-Chromium Steels. International Nickel Co.—Nickel Steel Data and Applications, no. 9, 16 pp., 14 figs. Presents physical properties of nickel and nickel-chromium steels by means of average curves and tables of maximum and minimum values in endeavour to provide reliable data which can be used as basis for engineering calculations.

NITROGEN

FIXATION. The Fixation of Nitrogen as Aluminum Nitride, H. J. Krase, J. G. Thompson and J. Y. Lee. Indus. & Eng. Chem., vol. 18, no. 12, Dec. 1926, pp. 1287-1290. Reviews history of aluminum-nitride process from standpoint principally of patent literature, together with chemistry of process; nitrification experiments on ferroaluminum alloys, showed that practically all aluminum in alloys could be nitrified if small amounts of such substances as cryolite, magnesium, aluminum, calcium fluoride or chloride were added to pulverized alloy before nitrification.

NUTS

STRENGTH OF. The Strength of Nuts, C. C. Pounder. Mech. World, vol. 80, no. 2081, Nov. 19, 1926, p. 399, 2 figs. For ordinary commercial purposes, Whitworth standard nut is doubtless satisfactory, although wasteful in material, but for light work, such as machinery of torpedo-boat destroyers or automobiles, it is quite common practice to use nuts of next smaller size, suitably drilled out; gives approximate calculations which will serve as guide to proportions which shall produce nut of strength equal to bolt.

O

OFFICE MANAGEMENT

WASTE ELIMINATION IN. Eliminating Waste in Office Supplies and Machinery, J. Mitchell. Soc. of Indus. Engrs. Bul., vol. 8, no. 10, Oct. 1926, pp. 21-27 and (discussion) 27-28. Design and printing of forms; central control of printed forms; form and service letters; reclamation of paper and binders and office appliances.

OIL

VISCOSITY. Effect of Dissolved Gas Upon the Viscosity and Surface Tension of Crude Oil, C. E. Beecher and I. P. Parkhurst. Am. Inst. Min. & Met. Engrs.—Trans., no. 1608-G, Dec. 1926, 13 pp., 10 figs. Results of experiments to confirm H. L. Doherty's claim that oil in undisturbed pool was different in character and behaviour than same oil when raised to surface of earth, and that gas dissolved in oil caused marked reduction in its viscosity and surface tension; results have proved that Doherty's contentions were correct in every particular.

OIL ENGINES

DEVELOPMENTS. Progress in Oil- and Gas-Power Engineering. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1421-1424. Progress report contributed by Oil and Gas Power Division of Am. Soc. Mech. Engrs., dealing with stationary engines, oil locomotives and large gas engines.

DOUBLE-ACTING. Double-Acting Oil Engines, W. S. Burn. Inst. Mar. Engrs.—Trans., vol. 38, Nov. 1926, pp. 281-301 and (discussion) 301-325, 10 figs.

HIGH-SPEED. A New High-Speed Oil Engine. Engineer, vol. 142, no. 3699, Dec. 3, 1926, pp. 614-616, 6 figs. Account of new type of engine capable of using wide range of fuels and of developing large power for its size and weight, built by A. G. Mumford under Mumford and Boothroyd patents; it is of medium compression airless-injection type, fuel being mechanically injected into cylinder by times valve at practically constant pressure.

SOLID-INJECTION. The Effect of Reduced Intake-Air Pressure and of Hydrogen on the Performance of a Solid-Injection Oil Engine, G. F. Mucklow. Automobile Engr., vol. 16, no. 222, Nov. 1926, pp. 463-471, 11 figs. Experiments carried out in engineering laboratories of University of Manchester on Crossley engine in which small quantities of hydrogen or coal gas were introduced along with air supply to engine.

OIL WELLS

GAS LIFTS. Notes on Gas Lift Process, R. P. McLaughlin. Am. Inst. Min. & Met. Engrs.—Trans., no. 1619-G, Dec. 1926, 4 pp. Importance of foot piece; velocity and density in well; results at California wells.

OXY-ACETYLENE WELDING

AUTOMOBILE-ENGINE CYLINDERS. The Welding of Cast Iron Internal Combustion Engine Cylinders, H. A. Horn. Am. Soc. Naval Engrs.—Jl., vol. 38, no. 4, Nov. 1926, pp. 904-911, 6 figs. Deals with welding of automobile-engine cylinders; enumerates principal casualties to cylinders and methods of repairing them by oxy-acetylene welding. Translated from German.

CITY GAS, USE OF. Welding and Cutting with City Gas, J. Geartner. Am. Gas Jl., vol. 125, no. 24, Nov. 13, 1926, pp. 587-588, 1 fig. Describes welding and cutting torches, developed by Alexander Milburn Co., Baltimore, Md., for cutting steel of varying thickness from ⅛ to 24 in., and for welding cast iron up to and including ½-in. thickness.

SINGLE-VEE WELDS. Ultimate Strength of Single-Vee Welds, E. E. Thum. Am. Welding Soc.—Jl., vol. 5, no. 11, Nov. 1926, pp. 23-26, 2 figs. Results of tests made by Union Carbide and Carbon Research Laboratories, showing measure of reliability of oxy-acetylene welding when done by men selected with reasonable care, and working under principles of procedure control.

P

PACKING

AUTOMATIC APPLIANCES. How Automatic Appliances Reduce Production Costs, A. Jacob. Indus. Mgmt. (Lond.), vol. 13, no. 12, Dec. 1926, pp. 507-508, 1 fig. Mechanical aspect of this subject; to-day, there are but few products of British factory which cannot be packed and handled by automatic means, and, as writer points out below, appliances are now available which are within reach of even smallest manufacturer, and which not only expedite output but which result in very considerable reduction of manufacturing.

PAINTS

WHITE. Cause and Prevention of Staining on White Paints, H. T. Morgan and J. H. Calbeck. Indus. & Eng. Chem., vol. 18, no. 12, Dec. 1926, pp. 1227-1228, 3 figs. Comparative staining of various paints; determination of staining component; prevention of staining.

PAPER MANUFACTURE

DRYING. Paper-Drying Process. Paper Trade Jl., vol. 83, no. 21, Nov. 18, 1926, pp. 43-44, 1 fig. Account of investigation by E. A. Briner and H. J. Guild to determine precisely how and where loss in strength occurs, and in order to develop suitable process and apparatus to retain substantially maximum strength and at same time produce flat and acceptable sheet.

SULPHITE PULP. The Hardness of Sulphite Pulp, D. A. Cameron and M. W. Phelps. Paper Trade Jl., vol. 83, no. 21, Nov. 18, 1926, pp. 39-41, 6 figs. Effect of lignin on pulp quality; methods of lignin determination; bleachability and hardness tests.

SULPHITE PULPING. Temperature Schedule in Sulphite Pulping, W. H. Swanson. Paper Trade Jl., vol. 83, no. 22, Nov. 25, 1926, pp. 46-47. Investigations have proved that, for high yield and quality of sulphite pulp, it is important that temperature during pulping period should rise very gradually in early part; application of this principle to certain leading cases is shown.

PAVEMENTS, ASPHALT

TYPES. Uses of Asphalt in Highway Construction, E. H. Scott. Can. Engr., vol. 51, no. 19, Nov. 9, 1926, pp. 625-626. Principal features of asphalt; new type of pavement tried in Ontario; asphalt macadam mixed type of pavement. Paper presented before Can. Good Roads Assn.

PIERS

CONCRETE. Design and Construction of Piers "B-C," Canadian Pacific Railway, at Vancouver, A. D. Wilder. Eng. News-Rec., vol. 97, no. 25, Dec. 16, 1926, pp. 984-989, 10 figs. Concrete substructure; upper deck for passengers; soft mud at side replaced by 1,373,000 cu. yd. of sand and gravel into which piles were driven by 17-ton hammer aided by jets.

REINFORCED-CONCRETE. Canadian Pacific Builds New Pier at Vancouver, B.C. Ry. Age, vol. 81, no. 21, Nov. 20, 1926, pp. 980-984, 5 figs. Reinforced-concrete is used for substructure of new facilities for Pacific ocean trade.

PIPING

DESIGNATION. Pipe-Line Designations, A. R. Nottingham. Power, vol. 64, no. 23, Dec. 7, 1926, p. 856. Objections to colour scheme; describes system used by Archilles Power Co., Iota, Mich., which has unlimited possibilities.

PILES

CONCRETE. Concrete Piles Impregnated with Asphalt for Sea-Water Use, G. F. Nicholson. Eng. News-Rec., vol. 97, no. 25, Dec. 16, 1926, pp. 990-992, 4 figs. Low-temperature impregnation method adopted for Los Angeles harbour after observation of concrete deterioration.

POLES, CONCRETE

BENDING STRENGTH. Reinforced-Concrete Poles, P. Gillespie and F. E. Wilson. Univ. of Toronto, School of Eng. Research—Bul., no. 6, pp. 27-50, 19 figs. Diagrams for strength in bending; how to use diagrams; problems illustrating use of charts; deflection of tapered poles; permissible pressure of side of pole against earth.

POWER GENERATION

OCEAN'S HEAT. Power from the Ocean's Heat. Power, vol. 64, no. 22, Nov. 30, 1926, p. 805. Review of lecture by G. Claude before French Academy of Science, demonstrating process evolved by him of generating power from warm water of tropical regions.

PRESSES

MECHANICAL FEEDS. Mechanical Feeds for Power Presses, E. V. Crane. Machy. (N.Y.), vol. 33, nos. 3 and 4, Nov. and Dec. 1926, pp. 161-165 and 266-271, 24 figs. Nov.: Their advantages, relation to design of press and methods of driving. Dec.: Various classes of feeding mechanisms and conditions governing their application.

PRESSURE VESSELS

STRESSES. Stresses Occurring in the Walls of an Elliptical Tank Subjected to Low Internal Pressures, W. M. Frame. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. Dec. 6-9, 1926, 15 pp., 9 figs. Results of tests made on elliptical tank; presents analysis based on experimental data, from which stresses set up in walls may be calculated.

PROSPECTING

ELECTRICAL. Geo-Electrical Prospecting, A. H. Rogers. Can. Min. Jl., vol. 47, no. 49, Dec. 3, 1926, pp. 1153-1156, 8 figs. Advantages and disadvantages of electrical prospecting; when it should and should not be employed.

PULVERIZED COAL

FINE PULVERIZATION. Making Coal Flow Like Water, W. E. Trent. Iron Age, vol. 118, no. 24, Dec. 9, 1926, p. 1619. Experiments conducted by author showing that coal, when pulverized to pass very fine mesh, can be made to flow and seek its own level. (Abstract.) Paper read before Int. Coal Conference at Pittsburgh.

INDUSTRIAL PLANTS. Pulverized Coal as Applied to Industrial Plants, W. E. Penfield. La. Eng. Soc.—Proc., vol. 12, no. 5, Oct. 1926, pp. 157-164 and (discussion) 164-177. Results of investigation of fuels and equipment made by E. Z. Opener Bag Co.; storage and unit systems of pulverized-coal utilization.

UNIT SYSTEM. Pulverized Coal, with Particular Reference to the Unit System, R. Jackson. Iron & Coal Trades Rev., vol. 113, no. 3063, Nov. 12, 1926, pp. 722-723. Storage vs. unit system; advantages of pulverized-coal firing. (Abstract.) Paper read before Instn. Fuel Economy Engrs.

PUMPS

AIR-LIFT. Air-Lift Pumping, H. T. Davey. Mech. World, vol. 80, no. 2082, Nov. 26, 1926, p. 423, 1 fig. Describes plant used for raising water from deep well to storage tank at top of tower, from which main water supply to large building is obtained.

BOILER-FEED. Boiler-Feed Pumps, D. G. McNair. Mech. World, vol. 80, no. 2080, Nov. 12, 1926, pp. 379-380, 1 fig. From point of view of keeping pump in state of efficient operation and amount of expense and labour involved thereby, independent pump, running at low speed and generally under most favourable conditions, will be much more easily kept in order, and consequently incur less labour and expense; reciprocating and centrifugal feed pumps.

PUMPS, CENTRIFUGAL

CHARACTERISTICS. Characteristics of Centrifugal Pumps, F. Johnstone-Taylor. Mech. World, vol. 80, no. 2082, Nov. 26, 1926, pp. 419-420, 8 figs. Effects of speed increase; constant speed and constant head; variable conditions.

PYROMETERS

CONES. Characteristics of Pyrometric Cones, C. O. Fairchild and M. F. Peters. Am. Ceramic Soc.—Jl., vol. 9, no. 11, Nov. 1926, pp. 701-743, 5 figs. Determination of characteristics under definite and reproducible conditions of heating.

R

RAILS

BREAKING OF. Self-Tempering and Surface-Strain Hardening of Rails in Service (Auto-trempe et écrouissage superficiels des rails en service), M. Sabouret. Revue Générale des Chemins de Fer, vol. 45, no. 2, Nov. 1926, pp. 370-393, 15 figs. Derailment of express at Grisolles, France, due to apparently perfect rail breaking into 21 pieces, which, on expert examination, was found to have been rendered brittle by skidding, etc.; proposes use of rail steel in which this hardening will increase rather than diminish.

CORRUGATION. Study of Corrugated Wear of Rails (Contribution à l'étude de l'usure ondulatoire des rails), C. Fremont. Génie Civil, vol. 89, no. 20, Nov. 13, 1926, pp. 425-428, 13 figs. Experiments in wear of rails by abrasion; tangential impact on tire of wheels due to sudden friction, and apparatus for recording it; study of microstructure, etc.

JOINTS, WELDED. A New Rail Joint, W. Spraragen. Am. Welding Soc.—Jl., vol. 5, no. 11, Nov. 1926, pp. 8-9, 1 fig. Author describes new form of joint particularly adapted to metal arc welding; it is really nothing more than straight butt joint made in rail without addition of fish plates and with or without addition of base plate to give additional strength.

TRANSVERSE FISSURE. A Transverse Fissure Detector. Ry. Eng. & Maintenance, vol. 22, no. 12, Dec. 1926, pp. 503-504, 4 figs. Magnetic deflectoscope, developed in Japan, is used on rails in track.

RAILWAY REPAIR SHOPS

COMPRESSED-AIR TOOLS. Air-Operated Tools Help Repair Locomotives, F. W. Curtis. Am. Mach., vol. 65, no. 25, Dec. 16, 1926, pp. 979-981, 9 figs. Outline of miscellaneous tools that cut costs; forming superheater-unit bands; stripper for steam-hose fittings; benders for pipes and eyes; automatic feeding attachments.

RAILWAY SIGNALLING

DAY-AND-NIGHT SIGNALS. Railway Signalling by Means of Luminous Signals, Day and Night (La signalisation des voies ferrées par signaux employés jour et nuit), J. Netter. Génie Civil, vol. 89, no. 15, Oct. 9, 1926, pp. 297-299, 4 figs. Discusses continuous use of lights in United States and in France, system of lenses used, power consumption of tungsten filament lamps, groups of signals, control; advantages.

TESTING SIGNALS. How to Test D.C. Low-Voltage Signals with a Volt-Ammeter, A. M. Weeks. Ry. Signalling, vol. 19, no. 12, Dec. 1926, pp. 466-469, 10 figs. Instructions governing method of using instrument in testing relays, circuits and grounds.

TRACK CIRCUITING. A New Development in Single Line and Either-Way Working. Ry. Gaz., vol. 45, no. 24, Dec. 10, 1926, pp. 698-700, 3 figs. Installation on L. N. E. R. (N.E. area), in which ordinary single-line token system has been replaced by track circuiting of improved type.

RAILWAY SWITCHES

ELECTRIC. Electric Switches and Signalling (L'électricité dans l'aiguillage et la signalisation), A. Bourgain. Nature, no. 2739, Oct. 2, 1926, pp. 209-215, 17 figs. Describes Aster electric switch control and battery motor for operating switches; also Mors and Klein motors for switch and signal operation.

RAILWAY TIES

CONCRETE. Concrete Ties in Open Track. Elec. Traction, vol. 22, no. 12, Dec. 1926, pp. 677-678, 4 figs. New type track construction tested by Pittsburgh, Harmony, Butler & New Castle Railway Co. utilizes concrete beam tie with rails held in alignment by spot-welded tie rods.

RAILWAY YARDS

FLOOD LIGHTING. Flood Lighting Brighten Classification Yards, G. T. Johnson. Ry. Rev., vol. 79, no. 22, Nov. 27, 1926, pp. 785-788, 6 figs. Outline of factors governing lighting of hump yards.

RAILWAYS

MECHANICAL ENGINEERING. Progress in Railroad Mechanical Engineering. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1427-1431. Progress report contributed by Railway Division of Am. Soc. Mech. Engrs., dealing with motive power, rolling stock, trend in development, union-management, co-operation and power-brake tests at Purdue Univ. Bibliography.

REFRACTORIES

BOILER-FURNACE. Refractories, R. A. Sherman, W. E. Rice and L. B. Berger. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1389-1396, 15 figs. Investigation of boiler-furnace conditions as related to refractories service.

CAST. Cast Refractory Blocks Give Highly Satisfactory Service. Fuels & Furnaces, vol. 4, no. 11, Nov. 1926, pp. 1339-1346. Cast refractories made by newly-developed method of melting in electric furnace and pouring into moulds show remarkable resistance to erosion in glass tanks. (Abstract.) Paper read before Am. Refractories Inst.

SILACENE. The Mining and Preparation of Silacene. Foundry Trade Jl., vol. 34, no. 536, Nov. 25, 1926, p. 463, 3 figs. Notes on mining and preparation of plastic refractory known as silacene.

REFRIGERATING MACHINES

ELECTROLUX. The Electrolux Refrigerator. Ice & Cold Storage, vol. 29, no. 344, Nov. 1926, pp. 297-298. In this system necessity for two regulating valves and mechanically-operated pump are avoided by introducing sufficient inert gas into evaporator and absorber to produce pressure in these vessels equal to difference between condenser and evaporator, and so arranging apparatus that hydrogen circulates continuously between evaporator and absorber. Review of paper by D. B. Bremner before Brit. Cold Storage and Ice Assn.

S

STEAM POWER PLANTS

Engineering, Progress in. Progress in Steam-Power Engineering. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1419-1421. Progress report contributed by Power Division of Am. Soc. Mech. Engrs. dealing with boiler-room equipment, turbine room, power-station heat cycles and industrial power.

Office Building. Operating a Private Power Plant in Competition with Purchased Power, T. V. Balch. Engrs. & Eng., vol. 43, no. 10, Oct. 15, 1926, pp. 269-277. Presents system of operating combined plant, generating electric energy and steam for servicing large high-class office building.

STEAM TURBINES

Impulse. Impulse Steam Turbines, W. J. Kearton. Elecn., vol. 97, no. 2527, Nov. 5, 1926, pp. 532 and 536, 2 figs. Prediction of heat drop and pressure; application to existing types of machine; effect of throttling factor; distribution at varying loads. Paper read before Sect. G. of Brit. Assn.

Marine. Recent Turbine Practice and Its Application to Ship Propulsion, E. A. Kraft. Engineer, vol. 142, no. 3699, Dec. 3, 1926, pp. 603-604, 3 figs. Considers more important recent advances in turbine design; means for increasing heat drop through turbine; improvements in high pressure; emphasizes necessity for high vacuum; improvements in working cycle; considers relative claims of regenerative feed heating and interstage reheating; principles underlying design of economical turbine plants; describes machinery arrangement of King George. Paper read before Schiffbautechnische Ges.

Rotors. Structural Features of the Steam Turbine Rotor, J. M. Downer. Gen. Elec. Rev., vol. 29, no. 12, Dec. 1926, pp. 829-832, 8 figs. Progress in turbine design and ratings; extreme care in manufacture of turbine wheels; magnetic and other tests; blade materials and methods of fastening; balance.

STEEL

High-Carbon. The Constitution of Steel and Cast Iron, F. T. Sisco. Am. Soc. Steel Treating—Trans., vol. 10, no. 5, Nov. 1926, pp. 800-813, 3 figs. Deals with structure of high-carbon steels and structural changes in these steels when they are heated and cooled through transformation ranges; methods for calculation of amount of various structural constituents present in hypoeutectoid, eutectoid and hypereutectoid steels.

Nickel. *See Nickel Steel.*

STEEL CASTINGS

Fatigue Strength. Test of the Fatigue Strength of Cast Steel, H. F. Moore. Univ. of Illinois Bul., vol. 23, no. 44, July 6, 1926, pp. 5-20, 37 figs. Chemical composition and heat treatment of steels; test specimens and methods of testing; test data and results; report of investigation conducted by Engineering Experiment Station of University of Illinois in co-operation with American Steel Foundries.

STEEL, HEAT TREATMENT OF

Electric. Electric Heat Treatment of Steel, E. P. Barfield. Elecn., vol. 97, no. 2530, Nov. 26, 1926, pp. 614-615, 3 figs. Improvements in furnaces; classification of equipment; automatic temperature control.

Facts and Principles. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treat.—Trans., vol. 10, no. 6, Dec. 1926, pp. 971-985, 4 figs. Properties and uses of alloy steels other than tool steels in general; discussion of various types of nickel steels.

Hardening. New Process for Superficial Hardening of Steels by Means of Nitration (Nouveau procédé de durcissement superficiel des aciers par nitruration), L. Guillet. Société des Ingénieurs Civils de France—Mémoires et Compte Rendu, vol. 79, nos. 7 and 8, July-Aug. 1926, pp. 519-523. New process due to Fry; finished pieces of certain special steels are heated to 500 deg. in ammonia atmosphere under pressure; sclereoscope and ball-hardness figures, etc.

Standard Specifications. Proposed New Heat-Treatments. Soc. Automotive Engrs.—Jl., vol. 19, no. 6. Dec. 1926, p. 556. Subdivision on Physical-Property Charts recommended heat treatments for S. A. E. Steel 4615, intended primarily for case-hardening.

STREAM FLOW

Regulation. Storage Required for the Regulation of Stream Flow, C. E. Sudler. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 10, Dec. 1926, pp. 1917-1955, 33 figs. Presents study followed by set of curves for determining dependable flow to be expected due to given reservoir capacity; discusses those factors due to which reservoir located on tributary or at point some distance up stream from point of use may be less useful than one having point of use corresponding with dam site; develops series of curves for predicting dependable flow at point of use in all such instances.

STREET CLEANING

Methods and Equipment. Street Cleaning Tables. Pub. Works, vol. 57, no. 10, Nov. 1926, pp. 387-392. Tabular data on apparatus used, areas cleaned in past year by each of several appliances and methods and expenditures for street cleaning in cities of all sizes from 2,000 to 6,000,000.

STREET RAILWAYS

Cars. A New Jointed Six-Axle Tram Car. Eng. Progress, vol. 7, no. 11, Nov. 1926, p. 294, 3 figs. Car installed on Duisburg street railway forms link between rigid single cars with large passenger space and tram trains consisting of motor car and several trailers; basic idea was to link together two equal cars in such way as to form single car, without materially reducing flexibility of subdivided train.

Light Electric Street Cars (Voiture automotrice électrique de tramways, type leger), A. Lartigue. Electricité & Mécanique, no. 14, Sept.-Oct. 1926, pp. 1-12, 19 figs. New car used by Paris Transport Co.; mechanical details, including chassis, suspensions, wheels and axles, brakes; electric details, including Thomson-Houston motors, switches, etc.; power consumption, motor heating in operation.

Street Cars of Aluminum. Iron Age, vol. 118, no. 24, Dec. 9, 1926, p. 1633. Aluminum street car built by Cleveland Ry. Co. for experimental purposes; aluminum-alloy parts of car are in form of forgings, castings, light plates, tubing and standard formed sections; few parts of body are of steel.

STRESSES

Concentration. An Investigation of Stress Concentration by Means of Plaster-of-Paris Specimens, R. E. Peterson. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1449-1452, 9 figs. Author shows that determination of stress-concentration factors by means of plaster-of-paris specimens is simple means of obtaining results which are close to or on safe side of fatigue results; mathematical stress-concentration factors based on theory of elasticity, as well as photo-elastic factors differ considerably from fatigue results for small holes and small fillets; three-dimensional problems in stress distribution, which cannot be solved photoelastically, may be investigated by tests of plaster-of-paris specimens.

STRUCTURAL STEEL

Corrosion. Corrosion of Structural Steel, F. N. Speller. Can. Machy., vol. 36, no. 23, Dec. 2, 1926, pp. 25-30 and 44-48, 4 figs. Established facts regarding corrosion in general; in corrosion of structural steel atmospheric corrosion plays most important part; effect of copper; preventive measures employed to combat corrosion of steel framework of buildings, bridges and similar structures.

SUBSTATIONS

Basement Type. Customer-Substation Construction, M. R. Summer. Elec. World, vol. 88, no. 24, Dec. 11, 1926, pp. 1214-1216, 7 figs. Features of basement type 4,000-volt substation which is provided with duplicate feed from underground cables; important equipment and details of construction.

SWITCHBOARDS

Selection. The Selection of Switchboards and Switchgear, S. W. Mauger. Gen. Elec. Rev., vol. 29, no. 12, Dec. 1926, pp. 848-854, 14 figs. Five general considerations; discussion of varying requirements by subdivision into classifications; features to be expected in various applications of switching equipment.

SWITCHGEAR

Design. Features of Modern Electrical Switchgear, G. C. Lamb. Power Plant Eng., vol. 30, no. 24, Dec. 15, 1926, pp. 1326-1330, 9 figs. Factors involved in designing switchgear to meet present-day heavy-interrupting requirements.

T

TELEPHONY

Carrier-Current. Carrier-Current Communication Over Transmission Lines, E. F. Carter. Gen. Elec. Rev., vol. 29, no. 12, Dec. 1926, pp. 833-845, 14 figs. Requirements to be fulfilled; single-frequency duplex equipment; inter-system communication; amount of carrier energy required; operation.

Development. The History and Development of the Telephone, O. Lodge. Instn. Elec. Engrs.—Jl., vol. 64, no. 359, Nov. 1926. pp. 1098-1114. Complications; advantage of permanent magnetism in telephone; transmission; contains appendix by R. Appleyard on practical details. Bibliography.

TELEVISION

Developments. Television, J. L. Baird. Experimental Wireless, vol. 3, no. 39, Dec. 1926, pp. 730-738 and (discussion) 738-739, 9 figs. History of television is linked up with that of selenium and may be said to date from discovery of light sensitive properties of that element; review of developments; description of device employed; account of system developed by author.

TERMINALS, RAILWAY

Freight. The Railroad Freight-Terminal, B. V. Crandall. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 601-608. Discusses characteristics of two kinds of terminal, final and intermediate; considerations involved in locating terminals properly; points out urgent need for proper co-ordination of transportation facilities, including motor transport; trap-car system used by railroads.

TEXTILE INDUSTRY

Mechanical Engineering in, Progress of. Progress in Textile Mechanical Engineering. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1425-1426, 2 figs. Progress report contributed by Textile Division of Am. Soc. Mech. Engrs. dealing with developments in textile industry, machinery, power, research, etc.

TIN

Characteristics. The Metal Tin—And Its Characteristics, R. C. Rowe. Can. Machy., vol. 36, no. 15, Oct. 7, 1926, pp. 23-25 and 50, 2 figs. Properties of tin; source of vein tin; deposits in China; actual mining of ore; gravity concentration; refining operations; use of metal.

TOOL STEEL

Non-Deforming. The Nature of Oil Hardening Non-Deforming Tool Steels, E. C. Bain and M. A. Grossman. Am. Soc. Steel Treat.—Trans., vol. 10, no. 6, Dec. 1926, pp. 883-895 and (discussion) 896-897, 9 figs. Fundamental characteristics of oil-quenching type of tool steels; data were obtained from measurements of hardness, impact, strength, change of dimension and determination of X-ray crystal structure; deductions are drawn as to preservation and subsequent destruction of austenite and this phenomenon is correlated with practical behaviour of steel in its various uses.

TORSION

Testing Machines. Apparatus for Testing Wire by Torsion. Engineering, vol. 122, no. 3176, Nov. 26, 1926, p. 679, 2 figs. Apparatus placed on market by A. J. Amsler & Co., Switzerland, consists of vertical column having three horizontal arms and base support.

TRACTORS

Industrial Application. Industrial Application of Tractors, W. Parrish. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 655-656, 6 figs. Describes application in lumber industry, coal mining, transportation of materials about manufacturing plants, freight handling, etc.

TRANSFORMERS

Automatic Load-Ratio Control. Automatic Load-Ratio Control for Cleveland Transformers, A. Palme. Elec. World, vol. 88, no. 24, Dec. 11, 1926, pp. 1221-1222, 2 figs. Voltage taps changed automatically without removing load; how operating requirements are met.

Cores. An Investigation into the Sectional Proportions of the Cores of Circular Core Type Transformers, W. B. Garrett. World Power, vol. 6, no. 36, Dec. 1926, pp. 292-298, 8 figs. Results of investigation into correct sectional proportions of transformer cores, object being to evolve method of determining, quickly and accurately, proportions necessary to obtain maximum core area in circle of given diameter.

Fire Hazard. The Fire Hazard of Large Transformers, C. H. Tupholme. Elec. Rev., vol. 99, no. 2559, Dec. 10, 1926, pp. 945-946. Relief of tank-fault pressure.

Load Tests. Load Tests Systematized on Distribution Transformers. Elec. World, vol. 88, no. 24, Dec. 11, 1926, p. 1223, 2 figs. Detection of overloading and of unbalanced loads and issuance of necessary work orders to relieve such conditions are duties of service engineer at Worcester (Mass.) Electric Light Co.

Polarity and Connections. Notes on Transformer Polarity and Connections, J. Auchincloss. Gen. Elec. Rev., vol. 29, nos. 11 and 12, Nov. and Dec. 1926, pp. 783-796 and 862-872, 54 figs. Nov.: Origin of transformer polarity; checking polarity by alternating and direct current; determination by wattmeter method. Dec.: Polarity and corrections in Y- group forms; and in -Y forms; polarity in Scott group forms; 6-phase group forms.

Radiator Valves. Transformer Radiator Valve, E. L. R. Bliss. Gen. Elec. Rev., vol. 29, no. 12, Dec. 1926, pp. 846-847, 6 figs. Transformers should be shipped oil-filled; need for radiator valve; construction of valve; no extra space required; advantages.

Voltage Regulation. Using Standard Transformers to Improve Voltage Regulation, F. W. Sawyer. Power, vol. 64, no. 18, Nov. 2, 1926, pp. 656-658, 8 figs. Shows how five to ten per cent adjustment in line voltage may be obtained with standard transformers in this way.

TUNNELS

Concrete Lining, Repairing. Repairing Old Concrete Lining on Two-Track Railroad Tunnel, H. H. Temple. Eng. News-Rec., vol. 97, no. 22, Nov. 25, 1926, p. 865, 2 figs. Grouting cracks followed by guniting onto mesh reinforcing successfully used on large-bore tunnel.

U

UNIVERSAL JOINTS

Application in Design. Action, Application and Construction of Universal Joints, C. W. Spicer. Soc. Automotive Engrs.—Jl., vol. 19, no. 6, Dec. 1926, pp. 625-634, 28 figs. Universal joints are divided into three general classes: grease-lubricated, oil-lubricated and non-lubricated; describes joints of several types made by various companies.

V

VALVES

Hydraulic Equipment. Building a Valve for a Pressure of Three and a Third Tons, D. H. W. Felch. Chem. & Met. Eng., vol. 33, no. 10, Oct. 1926, pp. 596-597, 1 fig. Acute problem in designing valves and seats arose as hydraulic equipment was converted to higher operating pressures.

VENTILATION

Ejector. Ejector Ventilation, G. Proeschel. Colliery Eng., vol. 3, no. 33, Nov. 1926, pp. 474-475, 5 figs. Method of calculation based on investigations of Rateau and Zeuner; application to mine ventilation; numerical example. Translated from Arts & Metiers.

Schools. The Mechanical Ventilation of the St. Louis Schools, E. S. Hallett. Heat. & Vent. Mag., vol. 23, no. 12, Dec. 1926, pp. 61-64 and 69, 2 figs. Diseases removable by ventilation; new sources of air pollution; bad odors in city air; problems of heat control not mechanical, but personal; comparison of various types of ventilation.

Subways. Ventilating the World's Largest Subaqueous Tube. Heat. & Vent. Mag., vol. 23, no. 10, Oct. 1926, pp. 80-81, 3 figs. System has been worked out for providing continuous supply of fresh air to guard against harmful effects from engine-exhaust gases in Estuary Subway being constructed between Oakland and Alameda, Cal.; use of expansion chamber to hold air under slight head.

Window. The Truth About Window Ventilation, H. W. Schmidt. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 11, Nov. 1926, pp. 755-756. Critical discussion of report of New York State Commission on ventilation, containing number of conclusions and among others certain ones pertaining to window-ventilating system; author claims this type of ventilation was tried out thoroughly, found wanting and discarded many years ago.

VENTURI METERS

Tube Characteristics. Venturi Tube Characteristics, J. W. Ledoux. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 9, Nov. 1926, pp. 1787-1796, 4 figs. Gives coefficients of discharge and losses of head determined from series of actual tests of 19 tubes ranging in size from 30 to 1 in.; results of tests of 8 tubes, obtained by other experimenters.

VIADUCTS

Steel, Reinforcing. Reinforcing a Steel Viaduct: Northern Pacific Ry. Eng. News-Rec., vol. 97, no. 20, Nov. 11, 1926, pp. 788-791, 7 figs. Towers strengthened by additional steel on columns and bracing; new girder spans; precast concrete slabs for ballasted track; methods of handling work under traffic.

VIBRATIONS

Structural. Some Aspects of Structural Vibration, W. P. Gigby. Structural Engr., vol. 4, no. 11, Nov. 1926, pp. 346-354, 10 figs. Air and sound waves; resonance; conventionally accepted evidence of vibration; precise measurement; direction of vibrational movement in buildings.

W

WAGES

Payment, Principles of. Principles of Wage Payment, A. B. Rich. Taylor Soc.—Bul., vol. 11, no. 4, Oct. 1926, pp. 214-218. Statement advocated by Manufacturers' Research Association; principles include three general types of payment: (1) piece work (general term for payment of individual on basis of amount of production); (2) group piece work; (3) day work.

WASTE

Reclamation. The Recovery and Use of Waste Materials, I. B. C. Kershaw. Indus. Chem., vol. 2, no. 22, Nov. 1926, pp. 485-488, 2 figs. Deals with mining and metallurgical wastes; recovery of metals in electro-plating works; slate-quarrying refuse; fireproof tiles from waste lime; recovery of tin and zinc.

WASTE ELIMINATION

Employee Co-Operation in. Employee Co-Operation in Elimination of Waste in Industry, G. Hodge. Soc. of Indus. Engrs. Bul., vol. 8, no. 9, Sept. 1926, pp. 15-20 and (discussion) 20-22. Deals with human factor in industry and its possible values in reducing waste of production.

WATER MAINS

Fire-Stream Capabilities. Fire-Stream Capabilities of Water Mains, F. Shepperd. Nat. Fire Protection Assn.—Quarterly, vol. 20, no. 2, Oct. 1926, pp. 142-147, 1 fig. What happens when excess capacity is required of main; water pressures on mains; fire streams supplied by various sizes.

WATER POWER

European Practice. Some Observations on European Water-Power Practice, A. J. R. Houston. Boston Soc. Civ. Engrs.—Jl., vol. 13, no. 8, Oct. 1926, pp. 329-354 and (discussion) 355-368, 21 figs. Indicates features of European practice brought to author's attention during 3 years of study in Switzerland, France, Germany and Spain; deals with dams, silt-removal basins, tunnels, surge tanks, penstocks and valves, Pelton wheels, low-head dams, reaction turbines, architecture, interconnection and government ownership. Bibliography.

Industrial Uses. Hydro-Electric Power in Industry, L. H. Davis. Indus. & Eng. Chem., vol. 18, no. 10, Oct. 1926, pp. 1058-1061. Water-power resources of United States; use of power by electrotechnical and electrometallurgical industries; transmission of power through manufactured commodities.

N.E.L.A. Committee Report. Report of Hydraulic Power Committee, 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-26, 30 pp., 24 figs. Reliability of hydro-electric units; forecasting water supply; vibration in hydraulic machinery; restriction in flow due to vegetable and animal growths in conduits; manufacturers' statements regarding developments in hydraulic field.

WATER SOFTENING

Zeolites for. Effect of Hydrogen-Ion Concentration in Revivifying Zeolites, O. R. Sweeney and R. Riley. Ind. & Eng. Chem., vol. 18, no. 12, Dec. 1926, pp. 1214-1216, 5 figs. It is shown that pH value of water softened should be important control constant for all waters for use in commercial softeners.

WATER SUPPLY

New York City. Additional Water Supply of 434 M.G.D. for New York. Eng. News-Rec., vol. 97, no. 17, Oct. 21, 1926, pp. 670-672, 2 figs. Gravity sources east of Hudson River with aqueduct delivering to Kensico terminal reservoir and thence to Hill View equalling reservoir of Catskill system.

Ontario. Water Supply System at Belle River. Contract Rec., vol. 40, no. 47, Nov. 24, 1926, pp. 1115-1116, 2 figs. Compact pumping and filter plant, typical of desirable type of water works for small municipality; serves population of about 900.

WATER TREATMENT

Algae and Weeds. Treatment of Algae and Weeds in Lakes at Madison, B. P. Domogalla. Eng. News-Rec., vol. 97, no. 24, Dec. 9, 1926, pp. 950-954, 8 figs. Obnoxious conditions of lake waters investigated and remedied; sodium arsenite and sulphate of copper applied by dragging and spraying; weed cutting.

WATER WORKS

Hydraulic Rams. Hydraulic Rams and Their Operation, F. Johnstone-Taylor. Water Works Eng., vol. 79, no. 24, Dec. 15, 1926, pp. 1583-1584, 1 fig. Devices are suitable for small water works; practically no cost in operation; valves should be properly designed.

WATT-HOUR METERS

Incorrect Registration. Some Causes of Incorrect Registration of Watt-Hour Meters, W. F. Walsh. Power, vol. 64, no. 20, Nov. 16, 1926, pp. 732-734, 6 figs. Author enumerates factors which cause incorrect registration and tells how to determine which is causing trouble.

WELDING

Aircraft Construction. Tests in Connection with Gas and Metal Arc Welding as Applied to Aircraft Construction, H. B. Hird. Am. Soc. Naval Engrs.—Jl., vol. 38, no. 4, Nov. 1926, pp. 879-892, 7 figs. Results of tests conducted by Norfolk Navy Yard to determine thermal effect of gas and metal arc welding as indicated by tensile and bending tests on material.

Electric. *Electric Welding, Arc.*

Fusion. Essentials in Fusion Welding, S. W. Miller. Am. Welding Soc.—Jl., vol. 5, no. 9, Sept. 1926, pp. 8-10. Matters that must be given careful attention are design, materials, methods, supervision, training and testing.

Iron and Steel. Welding of Iron and Steel, C. A. Adams. Am. Iron & Steel Inst. —Advance Paper, for mtg. Oct. 22, 1926, 71 pp., 51 figs. Discusses different processes of welding; their advantages, limitations and field of usefulness, with particular reference to welding of iron and steel. See also abstract in Iron Age, vol. 118, no. 18, Oct. 28, 1926, pp. 1194-196.

Oxy-Acetylene. *See Oxy-Acetylene Welding.*

WIRE

Steel. The Manufacture of Iron and Steel Wire in Germany. Wire, vol. 1, nos. 1, 2, 3, 4 and 6, May, June, July, Aug. and Oct. 1926, pp. 58-59, 87-88 and 105; 118-119 and 136; 194-195 and 212, 15 figs. Translation of article by H. Altpeter, published in Stahl u. Eisen, Apr. 16 and 23, 1925. See reference to original article in Eng. Index 1925, p. 785.

WIRE ROPE

Care and Maintenance. Care and Maintenance of Wire Rope, W. Voigtlander. Blast Furnace & Steel Plant, vol. 14, no. 11, Nov. 1926, pp. 461-464, 5 figs. How to measure wire rope; uncoiling or unreeling; lubrication; splicing and socketting.

WOOD

Protection from Moisture. Protecting Wood from Moisture, M. E. Dunlap. Ind. & Eng. Chem., vol. 18, no. 12, Dec. 1926, pp. 1230-1232, 1 fig. Results of experiments; effect of number of coats; relative efficiency of various coatings; prevention of warping.

Finishing. The Technology of Wood Stains and Fillers for Use with Lacquer, S. M. Silverstein. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1293-1296, 3 figs. Importance of fundamental research work on development of sound undercoating materials for use with lacquer; progress in development of non-grain raising water stains and rapid-drying water-base fillers.

The Use of Wood Lacquer Finishes, W. S. Edgar. Mech. Eng., vol. 48, no. 11a, Mid-Nov. 1926, pp. 1289-1290. Particulars regarding preparation of wood surfaces for finishing, and methods of applying pyroxylin lacquers that have proved successful in practice.

WOOD PRESERVATION

Processes. The Preservation of Wood, R. D. Prettie. Can. Inst. of Min. & Met. —Bul., no. 174, Oct. 1926, pp. 1095-1107, 2 figs. History of developments; Bethell (full-cell creosote), Lowry, Rueping, Burnett and Card processes.

Specifications. Wood Preservation. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 288, Aug. 1926, pp. 76-129, 13 figs. Specifications for preservative treatment; creosoted piles and timber for use in Atlantic Coast waters infested with marine borers; preservative treatment of Douglas fir; and for preservatives; method for determining strength of zinc-chloride solution; determination of zinc in treated timbers; forms for reporting inspection.

WOODWORKING

Progress in. Progress in the Woodworking Industries. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1411-1412. Progress report prepared by Wood Industries Division of Am. Soc. Mech. Engrs. dealing with conservation of supplies, research projects now under way, woodworking education in United States, developments in woodworking machinery and investigation of wood finishes.

Engineering Index

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29 West Thirty-ninth Street. New York, N.Y.

TREATMENT. Feedwater Treatment in Power Plants. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 25-28, 2 figs. Higher steam pressures and demand for higher ratings have made feedwater treatment problem of vital importance.

Recent Developments in Feedwater Treatment, E. H. Tenney. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 23-24, 2 figs. Practice in chemical methods of treatment, evaporation, deaeration, and stage feedwater heating.

BOILER FURNACES

AIR PREHEATERS. The Effect of Water-Cooled Walls on Preheater Performance, N. E. Funk. Mech. Eng., vol. 49, no. 1, Jan. 1927, pp. 25-28, 10 figs. Paper presenting data supplementing those given by author in previous one comparing performance of several types of air preheaters.

DRAUGHT PRACTICE. Forced, Induced and Natural Draught Practice. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 20-22, 1 fig. Developments in draught equipment have been in direction of more effective application rather than improvement in design of equipment.

HEAT BALANCE. Research on Calculation of Heat Balance and Use of Graphic Methods (Recherches relatives au calcul des bilans thermiques et applications des méthodes graphiques). Chaleur & Industrie, vol. 7, no. 78, Oct. 1926, pp. 566-571, 7 figs. Graphical calculation of heat balance of gas producers, fire-tube boilers, heating boilers, etc.; develops charts for purpose and gives examples of calculation.

TURBINE. New "Turbine" Furnace Developments. Eng. & Boiler House Rev., vol. 40, no. 7, Jan. 1927, p. 362, 1 fig. New addition to standard "Turbine" steam-jet forced-draught furnace design for steam, boiler and general furnace work.

WOOD REFUSE BURNING. Mechanical Handling and Firing of Wood Refuse, W. H. Rohr. Wood-Worker, vol. 45, no. 11, Jan. 1927, pp. 34-36, 4 figs. Modern installation of equipment for handling and firing wood refuse, which is giving excellent results.

BOILER PLANTS

AUTOMATIC. Boiler Plant Runs Automatically at Masurel Worsted Mills, C. J. Auclair. Power, vol. 64, no. 26, Dec. 28, 1926, pp. 975-978, 2 figs. Oil burners are switched on and off by steam pressure; feedwater system is equipped to operate without manual control; plant is equipped with feedwater meters, oil meters, recording pressure gauges and flue-gas pyrometer; steam is generated at total cost of 65 cents per 1,000 lbs.

CONVECTION HEAT UTILIZATION. Modern Apparatus for Utilizing Convection Heat in the Boiler House. Eng. & Boiler House Rev., vol. 40, no. 6, Dec. 1926, pp. 271-283, 15 figs. Review of apparatus designed to utilize heat of combustion other than radiant heat of furnace; deals with coal-drying air, air preheating, superheaters and steam reheaters and economizers.

EQUIPMENT. Steam Generating Equipment. Power Plant Eng., vol. 31, no. 2, Jan. 15, 1927, pp. 130-137, 13 figs. Developments in boiler construction; recent superheater developments.

BOILER OPERATION

EFFICIENCY. Advanced Boiler Practice, E. F. Miller. Tech. Eng. News, vol. 7, no. 6, Dec. 1926, pp. 259, 296 and 298. Summary of methods of obtaining highest efficiencies from boiler installations.

BOILERS

AUXILIARY HEATERS. Auxiliary Heater Increases Capacity of Existing Boilers, S. Bolitz. Power, vol. 65, no. 3, Jan. 18, 1927, pp. 98-99, 2 figs. Novel device designed to increase steam-raising capacity of existing boilers, patented by Russian engineer, W. Perlowsky.

DEVELOPMENTS. Developments in Boilers and Boiler Auxiliaries. Power, vol. 65, no. 1, Jan. 4, 1927, pp. 9-13, 7 figs. Increasing use is being made of radiant surface in steam boilers with water-cooled furnace walls; air preheating is gaining favour; for time being, high pressures have ascendancy over high temperatures; developments in industrial plants show trend toward pressures and temperature comparable with central-station practice.

HIGH-PRESSURE. Boiler Pressures Continue to Increase. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 35-37, 2 figs. Higher pressures and ratings bring out new designs and problems; reheat and water-screen boilers used in new stations.

IMPROVEMENTS. Boilers and Superheaters Show Improvements, A. D. Bailey. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 33-34, 3 figs. Higher pressures and temperatures, larger boilers, higher ratings, reheat boilers, water walls and improved appurtenances combine to make progress in this field notable.

LOCOMOTIVE. *See Locomotive Boilers.*

SCALE PREVENTION. Scale Prevention on Fire Tube Boilers. Universal Engr., vol. 44, no. 6, Dec. 1926, pp. 25-26, 1 fig. Survey of heavy scale formation in boilers of Monmouth Memorial Hospital, Long Branch, N.J., resulting in installation in 1923 of De-Concentrator supplied by Hagan Corp.; de-concentrator has entirely prevented formation of scale, sediment remaining in boiler being soft and readily washed out, and small in amount as compared with former quantity of scale.

WASTE-HEAT. Calculation of Heat Distribution in Kilns, Waste-Heat Boilers and Flues, R. R. Coghlan and T. H. Arnold. Concrete (Mill Section), vol. 30, no. 1, Jan. 1927, pp. 104-108, 1 fig. Method of checking operating results from waste-heat boilers and kilns; charts, tables and formulas to facilitate computations; calculating air required for combustion; raw-material gases and their analysis; heat absorption; heat calculation; comparison with direct-fired boilers.

BOLTS

ROUND UNSLOTTED-HEAD. Tentative American Standards for Round Unslotted-Head Bolts. Mech. Eng., vol. 49, no. 1, Jan. 1927, pp. 59-61, 6 figs.

BRIDGE ERECTION

PROGRESS. Fifty Years of Progress in Bridge Engineering. From the Brooklyn Bridge to the Liberty Bridge, D. B. Steinman. Brooklyn Engrs'. Club—Proc., vol. 25, Oct. 1926, pp. 14-27 and (discussion) 28-35, 20 figs. Review of outstanding elements of improvement in bridge design and construction with regard to material, foundation methods, theory of bridge design and aesthetics; review of progress in different types of steel-bridge construction.

PROGRESS, 1926. Bridge-Building Progress in 1926, C. R. Young. Contract Rec., vol. 40, no. 52, Dec. 29, 1926, pp. 53-54, 63 and 65, 3 figs. Achievements in bridge design and construction, particularly in completion of Great Delaware River Suspension Bridge, and Montreal and South Shore Structure; other notable bridge erections during year, both in Europe and America.

BRIDGES, CONCRETE

DEFECTS AND REPAIRS. Defects in New Concrete Bridge and Proposed Repairs. Eng. News-Rec., vol. 97, no. 27, Dec. 30, 1926, pp. 1080-1081, 1 fig. Arch ribs and posts of Klamath River bridge badly honeycombed by segregation; patching and jacketing recommended.

GIRDER. The Design of Two-Span Reinforced Concrete Girder Bridges, A. C. Hughes and C. S. Gray. Surveyor, vol. 70, no. 1823, Dec. 31, 1926, pp. 583-586, 7 figs. Considers following two methods; determination of moments and shears as indicated by influence lines; use of equivalent distributed load and employment of envelopes which give maximum moment and shear under all conditions of loading under such distributed load.

BRIDGES, HIGHWAY

MONTREAL. The Montreal-South Shore Bridge. Contract Rec., vol. 40, no. 52, Dec. 29, 1926, pp. 139-142, 5 figs. Will have total length of nearly two miles and main span of 1,000 ft. at height of 165 feet.; all piers in stream are built for height of 43 ft. from below low water upwards in limestone masonry as protection against action of ice shoves.

MOVING OF. Highway Bridge Moved Without Interrupting Traffic. Eng. News-Rec., vol. 98, no. 1. Jan. 6, 1927, pp. 8-10, 5 figs. Four-span steel structure, at Montebello, Cal., 400 ft. long, is jacked 15 ft. sideways while vehicles pass over it without decreasing speed.

BRIDGES, LIFT

CONTROL EQUIPMENT. Control Equipment for Movable Bridges, H. H. Vernon. Eng. World, vol. 30, no. 1, Jan. 1927, pp. 11-17, 8 figs. Deals with control for leaf, lock, gate and pump motors, solenoid brakes, signal lights and trolley circuits for electrically-operated bridges of bascule or lift type.

BRIDGES, RAILWAY

RAISING UNDER TRAFFIC. Steel Railroad Bridge Raised 21 Feet Under Traffic. Eng. News-Rec., vol. 97, no. 26, Dec. 23, 1926, pp. 1034-1035, 4 figs. Reservoir necessitates Union Pacific line change; raised spans rested on concrete blocks while new concrete sets.

THAMES RIVER PROJECTS. Thames Bridge Projects. Engineering, vol. 122, no. 3179, Dec. 17, 1926, pp. 754-755, 3 figs. Schemes for new Ludgate and Charing Cross bridges, abstracted from report of Royal Commission on Cross River Traffic in London; bridge will be of double-deck structure carrying six railway tracks on lower floor and 70-ft. to 75-ft. road on upper deck.

BRIDGES, STEEL

STRENGTHENING. Strengthening Steel and Iron Bridges, T. H. Bryce and T. J. Gueritte. Can. Engr., vol. 51, no. 24, Dec. 14, 1926, pp. 715-716. Use of reinforced concrete in repairing and strengthening steel bridges. Paper read before Royal Sanitary Inst. Congress.

BUILDING CONSTRUCTION

CODES. Writing a New Building Code, F. A. Muth. Eng. News-Rec., vol. 97, no. 26, Dec. 23, 1926, pp. 1038-1039. How New Orleans handled problem with aid of engineering societies; pile foundation and wind-pressure provisions.

SPECIFICATION. A Bibliography of Architectural Specifications, W. W. Beach. Arch. Rec., vol. 61, no. 1, Jan. 1927, pp. 75-83. Compilation of bibliography on subject of specifications relating to building construction.

WINTER. Winter Construction, S. E. Thompson. Boston Soc. Civ. Engrs.—Jl., vol. 13, no. 10, Dec. 1926, pp. 427-433 and (discussion) 433-444. In materials, as well as labour, there is advantage of lower costs in winter due to smaller quantity of materials sold; factors of much importance are overhead and saving in capital on investment; consideration of advantages and disadvantages of winter construction; examples.

C

CABLES, ELECTRIC

HIGH-PRESSURE. A High-Pressure Cable Development. Elec. Rev., vol. 99, no. 2560, Dec. 17, 1926, p. 991, 7 figs. Details of Hochstadter or "H" cable; comparison between cable of this type and existing belted cable shows marked superiority of "H" cables, both as regards dielectric power factor and loss.

HIGH-VOLTAGE TERMINAL. Barrier-Type High-Voltage Terminal, A. M. Meyers. Elec. World, vol. 88, no. 26, Dec. 25, 1926, pp. 1323-1324, 3 figs. Flaring oil-filled metallic shield joined to cable sheath relieves and redistributes stresses at end of sheath, increasing puncture and flashover voltage.

60,000-VOLT. 60,000-Volt Cable Operating Four Years. Elec. News, vol. 36, no. 2, Jan. 15, 1927, pp. 32-34, 3 figs. Successful experience in Paris lends support to similar installation in Montreal; 2,000,000 kw.-hrs. transmitted daily.

CAMS

SCREW-MACHINE. Model for Designing Screw Machine Cams, H. Simon. Machy. (Lond.), vol. 29, no. 739, Dec. 9, 1926, pp. 297-302, 12 figs. Diagram model which solves problems of turret-tool clearance, turret-tool head and machine-bed clearance, interference of turret-tool stems, cut down on cam lobes, adjustment of turret slide, limits of turret- and cross-tool locations, interference of turret tools with product, etc.

CANALS

NEW ORLEANS. The Inner Harbour Navigation Canal at New Orleans, H. Goldmark. Brooklyn Engrs'. Club—Proc., vol. 25, Oct. 1926, pp. 36-49, 3 figs. Canal is 5 1-3 miles in length and consists essentially of three sections: (1) channel 2,000 ft. long and of varying widths from river to end of lock; (2) ship lock having usable length of 600 ft., clear width of 75 ft. and depth of water of 30 ft. on sills; (3) canal proper, which extends from other end of lock to Lake Pontchartrain; this section being 300 ft. wide at water level, and 150 ft. at bottom with depth of 30 ft.

CARS

DRAFT GEARS. The Operation and Testing of Draft Gears, A. F. Stuebing. Ry. Mech. Engrs., vol. 101, no. 1, Jan. 1927, pp. 19-23. Methods used in testing and their importance in draft-gear design.

CARS, PASSENGER

LACQUER FINISHES. Lacquer Finishes as Applied to Passenger Cars and Locomotives, R. M. Cook. South. & Southwestern Ry. Club, vol. 18, no. 12, Nov. 1926, pp. 34-61. Consideration of use of pyroxylin on passenger cars.

CASE-HARDENING

NITROGEN. Nitrogen Case-Hardening Process Brought to This Country. Automotive Industries, vol. 55, no. 25, Dec. 16, 1926, p. 1013. System of producing hard case on steel parts by causing diffusion of nitrogen into surface layer of steel.

CAST IRON

ELECTRIC ALLOY. Electric Iron Has Close Grain. Foundry, vol. 54, no. 22, Nov. 15, 1926, pp. 909-910, 4 figs. Alloy metal made in electric furnace has dense pearlitic structure and may be machined readily at high Brinell hardness; applications diversified; results of experiments for past two years by Vulcan Mold & Iron Co., Latrobe, Pa.

PROBLEMS. A Sceptic in the Iron Foundry, A. Allison. Foundry Trade Jl., vol. 34, no. 541, Dec. 30, 1926, pp. 567-568, 1 fig. Rules for pig iron; what happens at foundry; quality of cast iron turns largely upon total carbon contents and its condition; points out that cast iron calls for much greater care in control if higher quality could be obtained.

CASTING

ALLOY. Contraction in Alloy Casting, H. C. Dews. Foundry Trade Jl., vol. 34, no. 540, Dec. 23, 1926, pp. 541-544, 7 figs. Discusses ways in which soundness of castings is related to volume changes brought about by change of temperature; deals with liquid, solid and pasty state of metals; what happens when alloys freeze; location of contraction cavity; equal section not desirable; alloys with freezing ranges.

CENTRIFUGAL. Centrifugal Casting of Steel, L. Cammen. Soc. for Steel Treating—Preprint, no. 4, for mtg. Jan. 20-21, 1927, 35 pp., 11 figs.

CASTINGS

DEFECTIVE, RECLAMATION OF. The Reclamation of Defective Castings, C. W. Brett. Metal Industry (Lond.), vol. 29, no. 24, Dec. 10, 1926, pp. 561-562, 2 figs. Claims that it is now possible, on average basis, to reclaim at least 50 per cent of ordinary foundry scrap heap, and rapidly and economically restore it to full efficiency by one or other of half-dozen welding processes regularly employed; practical application of scientific methods; detection of welding imperfections.

CEMENT, PORTLAND

CLINKER. The Constitution of Portland Cement Clinker, R. H. Bogue. Concrete, vol. 30, no. 1, Jan. 1927, pp. 33-37, 1 fig. Studies based on phase rule of Gibbs; phase diagram and its interpretation; CaO_3, Al_2O_3 and SiO_2 system; importance of other systems; Rankin's deducations; hydraulic constituent of cement clinker; studies of heating and cooling curves; Dyckerhoff's findings.

HIGH EARLY STRENGTHS. Securing High Early Strengths from Ordinary Portland Cement, H. S. Van Scoyoc. Contract Rec., vol. 40, no. 52, Dec. 29, 1926, pp. 75-77. Effect of calcium chloride.

MANUFACTURE. Recent Improvements in Making Portland Cement, F. W. Kelley. Eng. News-Rec., vol. 98, no. 2, Jan. 13, 1927, pp. 84-87, 5 figs. Man-hour productivity increased and price kept level in face of rising costs by larger kilns, waste-heat utilization, higher steam pressure and heat, larger and more efficient manufacturing units.

CENTRAL STATIONS

DESIGN. Modern Power Plant Trends. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 2-7, 9 figs. Effort to achieve greatest heat economy and heat adaptation to conditions is evident; developments in boilers, superheaters, stokers, economizers and air preheating, draught practice, feedwater systems, condensers, generators, electrical switching and transformation and steam turbines.

CHROME STEEL

ENGINE EXHAUST VALVES. Chrome Steels and Cobalt Steels (Sur les aciers au chrome et au cobalt), F. M. Ostroga. Académie des Sciences—Comptes Rendus, vol. 193, no. 20, Nov. 15, 1926, pp. 882-885. Expansion and microstructure of chrome and cobalt steels used for exhaust valves in certain engines; facility of super-tempering them in air after heating to comparatively low temperature, etc.

CITIES

CENTRAL CONTROL. Saskatchewan's Centralized Supervision of Municipalities Gives Satisfaction, J. N. Bayne. Nat. Mun. Rev., vol. 15, no. 12, Dec. 1926, pp. 689-693. Saskatchewan's extensive central control over municipalities is divided between Department of Municipal Affairs and Local Government Board; former guides general administration, supervises accounts and has charge of all municipal legislation before provincial legislature; latter controls borrowings and keeps watchful eye upon sinking funds; why two agencies are necessary.

CITY PLANNING

REGIONAL PLANNING. Regional Planning in Milwaukee, R. E. Behrens. Eng. Soc. of Wis.—Bul., vol. 1, no. 3, July 1926, pp. 153-156 and (discussion) 157-161. Review of activities of Regional Planning Department and results obtained.

ZONING. Relation of Zoning Ordinances to House Widths, A. Richards. Eng. News-Rec., vol. 97, no. 27, Dec. 30, 1926, pp. 1078-1079. Proposed Altoona ordinance based on formula devised and designed to meet practical requirements; some contrasts.

COAL

BRIQUETTING. Briquet Binder Containing Residues from Alcohol Manufacture, W. C. Moore and H. A. Myers. Indus. & Eng Chem., vol. 19, no. 1, Jan. 1927, pp. 147-149. Presents series of formulas for use of evaporated molasses residue as constituent of binder for making briquets from anthracite; in general, such briquet must be baked to at least 600 deg. Fahr. for not less than 30 minutes; combination of evaporated molasses residue, asphalt, sodium carbonate, calcium chloride and sulphur makes excellent binder for anthracite coal briquets.

DRY SEPARATION. The Dry Separation of Small Coal, W. H. and S. R. Berrisford. Instn. Min. Engrs.—Trans., vol. 72, Nov. 1926, pp. 97-109 and (discussion) 109-113, 12 figs. Review of progress; methods employed and some machines constructed up to present time; results of experiments and their influence on machine design.

UTILIZATION. Recent Developments in the Science of Coal Utilization, C. H. Lander. Mech. Eng., vol. 49, no. 1, Jan. 1927, pp. 1-11, 17 figs. Constitution of coal; analysis; preparation for market; low-temperature carbonization; low-temperature coke and tar metallurgical coke; production of free-burning coke by high-temperature methods; pulverized coal and structure of cenospheres; production of oil from coal by methods other than carbonization. Robert Henry Thurston lecture on Relation between Engineering and Science.

COAL HANDLING

GAS WORKS. Gas Works Coal-Handling Plant. Engineering, vol. 122, no. 3180, Dec. 24, 1926, pp. 779-781, 13 figs. partly on p. 788. Details of unloading transporter, cableway conveyer, protection bridges loading stations and telpher transporter; cableway is of double-rope type.

COLUMNS

WIDE-WEB. Compressive Strength of Column Web Plates and Wide-Web Columns, R. S. Johnston. U.S. Bur. of Standards—Technologic Papers, no. 327, Oct. 2, 1926, pp. 733-782, 28 figs. Investigation to verify design rule on wide-web plates in compression should not exceed in width 30 times thickness of plate; includes study of strength of laterally-supported wide-web columns and comparison of merits of single-plate and double-plate webs of equal thickness; shows that buckling strength is also dependent upon mechanical properties of material and that buckling resistance of plate may be computed for known material.

CONCRETE

GRAVEL-PIT AGGREGATES. Practical Concrete, H. C. Badder. Roads & Road Construction, vol. 4, no. 47, Nov. 1, 1926, pp. 357-359, 2 figs. Use of aggregates from gravel pit.

CONCRETE, REINFORCED

SHEAR REINFORCEMENT. The Essentials of Reinforced Concrete Design, E. S. Andrews. Structural Engr., vol. 4, no. 12, Dec. 1926, pp. 370-374, 4 figs. Shear reinforcement.

CONDENSERS, STEAM

DEVELOPMENT. Progress in Condenser Design. Power Plant Eng., vol. 31, no. 2, Jan. 15, 1927, pp. 143-146, 5 figs. Statements by various manufacturers.

IMPROVEMENTS. Condenser Practice Trends Well Defined, H. W. Leitch. Power Plant Eng., vol. 31, No. 1, Jan. 1, 1927, pp. 47-48, 1 fig. Steam extraction and increased size of units further complicate condenser selection while improved designs and auxiliaries give better performance with possibility of further gains.

TUBES. Cleaning Condenser Tubes. Power, vol. 65, no. 2, Jan. 11, 1927, p. 64. Laboratory experiments by Elliot Co. indicate that proper acid concentration to use in removing condenser-tube scale is 2.5 per cent solution by volume of hydrochloric acid for treatment of one hour's duration.

Heat Transfer Through Wet Condenser Tubes, R. H. Andrews. Power, vol. 64, no. 26, Dec. 28, 1926, pp. 981-982, 3 figs. Speculations on nature and rate of heat transfer from steam through wet condenser tubes; author concludes that dry tube is most efficient, but that after film has once formed, thick film gives better heat transfer than thin one; suggests application of these ideas to condenser design.

CONVEYORS

PNEUMATIC. Pneumatic Conveying Plants for Agricultural Purposes, L. Engelbrecht. Eng. Progress, vol. 7, no. 12, Dec. 1926, pp. 327-328, 3 figs. Advantages and disadvantages of blowers, and kinds of materials which are suitable for pneumatic transport.

COPPER ALLOYS

HIGH TEMPERATURES. Copper Alloys for High Temperatures, M. G. Corson. Brass World, vol. 22, no. 12, Dec. 1926, pp. 389-390, 1 fig. Additions of cobalt, chromium, silicides and beryllides has peculiar effects on hardness; diagram shows author's results of tests.

CORE OVENS

GAS-FIRED. Gas Scores When Baking Cores, R. G. Van Gundy. Am. Gas Assn. Monthly, vol. 9, no. 1, Jan. 1927, pp. 19-22 and 48, 2 figs. Points out that advantages of gas fuel are readily apparent in study of conditions that have to be met.

COST ACCOUNTING

CONTRACT SHOPS. Cost Estimating in Contract Shops, J. A. Thomas. Machy. (N.Y.), vol. 33, no. 5, Jan. 1927, pp. 369-370. Factors that enter into estimate; information recorded on time estimate sheet.

INDUSTRIAL PLANTS. Costs in Profitable Manufacturing, W. L. Walker. Mfg. Industries, vol. 12, nos. 3 and 4, Sept. and Oct. 1926, pp. 213-216 and 293-297. Under conditions of competitive manufacture, facts secured by efficient up-to-date cost system may have numerous uses in managing concern in profitable channels; prominent among these uses are determining of actual costs of expense orders, such as repairs, renewals, etc.; actual costs of construction and equipment cost of goods sold to ascertain profit and loss on salts made by groups or individual items.

CRANES

LOCOMOTIVE. A Locomotive Crane for Lifting 120 Tons, E. Altschul. Brown Boveri Rev., vol. 13, no. 12, Dec. 1926, pp. 279-282, 6 figs. Noteworthy crane of this type installed in Yverdon Repair Shops of Swiss Federal Railways; used for moving heaviest electric locomotives as well as for lifting either small or heavy loads during erection.

50-Ton Overhead Travelling Cranes, Horwich Works, L.M.S.R. Ry. Gaz., vol. 45, no. 27, Dec. 31, 1926, p. 787, 1 fig. Built to meet special conditions involved by large modern locomotives.

WHARF AND WAREHOUSE. Wharf and Warehouse Cranes, C. H. Woodfield. Elecn., vol. 97, no. 2535, Dec. 31, 1926, pp. 754-755 and 762, 3 figs. Electrical vs. hydraulic operation; layout details; braking systems; luffing devices.

CRANKSHAFTS

BALANCING. Balancing Rotating Parts. Automobile Engr., vol. 16, no. 223, Dec. 1926, pp. 491-492, 2 figs. Gisholt method as applied to crankshafts, flywheels, etc.

CULVERTS

CORRUGATED. Large Diameter Corrugated Culverts Instead of Small Bridges, A. S. Rosing. Contract Rec., vol. 40, no. 51, Dec. 22, 1926, pp. 1208-1211. Advantages which make them adaptable to crossing of small streams; how to determine size of culvert required.

CYLINDERS

LAPPING. Bethel-Player Lapping Machines. Machy. (N.Y.), vol. 33, no. 5, Jan. 1927, pp. 385-386, 2 figs. Two new machines built by Bethel-Player Co., Westboro, Mass.; one is intended for use on cylindrical and flat parts in shops where production does not warrant one of larger machines built by this concern; other is designed for simultaneously lapping three parallel cylindrical holes in parts.

MACHINING. Cylinders for Outboard Motors, F. W. Curtis. Am. Mach., vol. 65, no. 26, Dec. 23, 1926, pp. 1027-1030, 15 figs. Inspecting castings for leakage; boring and reaming cylinders; various drilling operations; milling ports; hand-reaming and grinding bore; materials-handling truck.

Machining Cylinder Heads. Machy. (Lond.), vol. 29, no. 742, Dec. 30, 1926, pp. 409-413, 10 figs. Practice of Morris Motors (1926), Ltd., Engines Branch, Coventry.

D

DAMS

CONCRETE. The Melones Dam and Power Project, F. Wilkins. Contractors' & Engrs'. Monthly, vol. 13, no. 6, Dec. 1926, pp. 50-55, 6 figs. Details of constant-radius concrete-arch type structure, designed to impound estimated capacity of 112,500 ft. of water; it was poured entirely by gravity from construction trestle across top, concrete plant being located high on canyon side; foundations and abutments; drilling tunnel; power-house equipment.

MARTIN, ALABAMA. Construction Methods and Plant at Martin Dam, Alabama, L. G. Warren. Eng. News-Rec., vol. 97, no. 27, Dec. 30, 1926, pp. 1064-1071, 14 figs. Elaborate derrick plant served by job railway handled excavation, concrete and forms; sawmill and crushing plant important adjuncts; camp layout.

MULTIPLE-ARCH. Highest Multiple-Arch Dam in the World to Be Located Near Phoenix, Arizona. Modern Irrigation, vol. 2, no. 12, Dec. 1926, pp. 13 and 36. Lake Pleasant structure will rise total of 250 ft. from bed rock; duty of dam is to impound 173,500 acre ft. of water in lake 8 miles long and 2 miles wide for irrigation of 40,000 acres of land.

MULTIPLE-DOME. Engineering Aspects of Coolidge Dam Excite Interest of Hydraulic World. Modern Irrigation, vol. 2, no. 12, Dec. 1926, pp. 11-12 and 20, 9 figs. on supp. plate. Multiple-dome structure of San Carlos project of Arizona will be first of its kind in world.

DIESEL ENGINES

AMERICAN INDUSTRY. The Diesel Engine's Position in American Industry, L. H. Morrison. Power, vol. 65, no. 2, Jan. 11, 1927, pp. 60-63, 8 figs. As revealed by survey of existing installations.

LUBRICATING-OIL RECTIFICATION. Oil Rectification. Automobile Engr., vol. 16, no. 223, Dec. 1926, pp. 494-495, 8 figs. Continuous renovation of lubricating oils.

THERMAL EFFICIENCY. Investigations on the Efficiency of Diesel Engines, M. Ino. Soc. Mech. Engrs. (Japan)—Jl., vol. 29, no. 115, Nov. 1926, pp. 619-675, 30 figs. Deals with theoretical thermal efficiencies of actual cycles which seem likely to take place in Diesel engine cylinder; comparison of theoretical thermal efficiencies of various cycles based on new theory; comparison of thermal efficiencies in airless-injection and air-injection engines under new theory of thermal efficiencies worked out by author.

DIRECTION FINDING

RADIO DIRECTION FINDER. A Portable Radio Direction Finder for 90 to 7,700 Kilocycles, F. W. Dunmore. U.S. Bur. of Standards—Sci. Papers, no. 536, Oct. 21, 1926, pp. 409-430, 13 figs. Describes instrument with but two controls (balancing and tuning) which operates over frequency band from 90 to 7,700 kilocycles; it is simple rotating-coil type.

DRAINAGE

MISSOURI. Studies and Works of a Missouri Drainage District, J. A. Harman. Eng. News-Rec., vol. 97, no. 27, Dec. 30, 1926, pp. 1074-1077, 4 figs. Adjacent districts co-operate for outlets; run-off formula; assessments and taxes; flat side slopes prevent caving of ditches; pumping plant; profit-sharing contract and cost accounting.

DRILLING

DEEP-HOLE. Deep-Hole Drilling in Rifle-Making, A. Murphy. Can. Machy., vol. 37, no. 2, Jan. 13, 1927, pp. 13-16, 10 figs. Unusual machining operations, necessitating both special and standard equipment found in Toronto rifle plant; groove cutting, straightening and manufacture of small parts.

DRILLING MACHINES

MULTIPLE-SPINDLE. An Interesting Example of Multiple-Spindle Drilling. Brit. Machine Tool Eng., vol. 4, no. 42, Dec. 1926, pp. 502-504, 4 figs. Interesting example of process in works of one of largest British commercial vehicle builders.

WIDE PLATES. A New Machine for Wide Plate Drilling. Brit. Machine Tool Eng., vol. 4, no. 42, Dec. 1926, pp. 497-498 and 520, 2 figs. New bogie pattern-plate radial drilling machine made by Wm. Asquith, Ltd., Halifax.

DURALUMIN

HARDNESS TESTING. Hardness Testing of Thin Duralumin Sheet, T. W. Downes. Forging—Stamping—Heat Treating, vol. 13, no. 1, Jan. 1927, pp. 18-23, 3 figs. Methods of hardness testing and relation between hardness and mechanical properties of heat-treated, rolled duralumin sheet.

E

ECONOMIZERS

DRAUGHT LOSS. Note on Economizer Draught Loss, B. M. Thornton. Mech. World, vol. 80, no. 2086, Dec. 24, 1926, p. 500, 2 figs. While it is shown that draught loss for most economical thermal efficiency is much higher than is generally realized, it should be borne in mind that this loss is not necessarily most economical for commercial efficiency; increased draught loss results in larger heat transfer in economizer, with result that economizer absorbs more heat and overall plant efficiency is increased.

High Pressures. Economizers Developed to Meet High Pressures. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 29-32, 5 figs. Steel tubes with protected surfaces are outstanding features of economizer development.

EDUCATION, ENGINEERING

CURRICULA. A Summary of Opinions Concerning Engineering Curricula. Eng. Education—Jl., vol. 17, no. 4, Dec. 1926, pp. 356-392, 8 figs. Two groups have been made, one dealing with content and arrangement of present-day curricula and evolutionary changes through which they have reached present form, and other with opinions of those most directly concerned as to fitness of curriculum for preparing student for his profession.

EXTENSION COURSES. Extension Courses in Engineering, C. M. Jansky. Eng. Education—Jl., vol. 17, no. 4, Dec. 1926, pp. 410-423 and (discussion) 423-427. Preliminary report and condensed summary of results.

ELECTRIC DISTRIBUTION SYSTEMS

BROOKLYN, N.Y. Recent Progress in Distribution Practice of the Brooklyn Edison Company, Inc., J. F. Fairman and R. C. Rifenburg. Am. Inst. Elec. Engrs. —Jl., vol. 46, no. 1, Jan. 1927, pp. 38-45, 6 figs. Changes in transmission and distribution system of Brooklyn Edison Co. during past four years; in 1927 low-voltage, a.c. network will be installed, and this will be extended to care for load growth until it becomes principal supply system for low-tension energy in Brooklyn; tests made to determine whether arcing and short-circuit faults in network will be self-clearing, permissible voltage fluctuations on incandescent lamps, and dissipation of heat from transformer vaults.

SECONDARY DISTRIBUTION. Graphic Solutions of Secondary Distribution Problems, M. C. Hughes. Elec. World, vol. 88, no. 26, Dec. 25, 1926, pp. 1320-1323, 2 figs. Development of simple chart of secondary calculations from elements of load and line conditions; method of use of chart and application to ordinary secondary distribution problems.

SHORT-CIRCUITS. Short-Circuit Currents, G. Cluley. Elec. Rev., vol. 99, nos. 2559 and 2560, Dec. 10 and 17, 1926, pp. 943-945, 986-987, 8 figs. Calculations on large interconnected 3-phase distribution system.

ELECTRIC FURNACES

BRASS FOUNDRIES. Use of the Electric Furnace in Non-Ferrous-Metal Foundries (L'utilisation des fours électriques dans la fonderie des alliages et des métaux non ferreux), A. Levasseur. Société Française des Electriciens—Bul., vol. 6, no. 60, Aug. 1926, pp. 893-913, 9 figs.

FACTORIES. Electric Furnaces in Manufacturing, N. R. Stansel. Iron & Steel Engr., vol. 3, no. 12, Dec. 1926, pp. 497-502, 11 figs. Details of electric-furnace equipment in Schenectady Works of General Electric Co.; while equipment includes both arc and induction furnaces, resistor-type furnace is by far most general in use; bulk heating; heat-treatment processes; maintenance.

HEAT-TREATING. Electric Rotary Furnace Automatically Operated, I. S. Wishoski. Fuels & Furnaces, vol. 5, no. 1, Jan. 1927, pp. 71-74 and 98, 5 figs. Furnace designed by Westinghouse Elec. & Mfg. Co. for heat-treating of ball races; heat-treating operation is entirely automatic from time charge is placed in pan on hearth until it is discharged into basket by quenching tank conveyor; very uniform results are obtained.

ELECTRIC GENERATORS

CONNECTION. Features of the Generator Connection. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 62-65, 2 figs. There is growing tendency to connect generator directly to primary of step-up transformers.

FIRE EXTINGUISHERS IN. Extinguishing Fires in Hydro Generator Windings, J. E. Housley. Power, vol. 64, no. 26, Dec. 28, 1926, pp. 979-980, 3 figs. System of spraying water on windings, in case of fire in machine, has been installed in number of units; for one fire alone this saved many times installation cost of protection.

PRACTICE. Electric Generator Practice. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 55-57, 1 fig. Sizes used, voltages and methods of voltage control, practice in furnishing current for house supply.

ELECTRIC GENERATORS, A.C.

SYNCHRONOUS. The Hunting of Synchronous Machinery, R. Lochner. Instn. Elec. Engrs.—Jl., vol. 65, no. 360, Dec. 1926, pp. 81-89, 8 figs. Deals with problem of hunting from mathematical standpoint with view to obtaining methods which will truly indicate, with minimum amount of calculation, whether or not hunting is likely to occur in any particular case.

ELECTRIC RAILWAYS

REPAIR SHOPS. Progressive Routing of Work Features New B.M.T. Shop. Elec. Ry. Jl., vol. 68, no. 25, Dec. 18, 1926, pp. 1081-1086, 9 figs. Electrical repair building is first of new Coney Island repair shops to be used by Rapid-Transit Division of Brooklyn-Manhattan Corp.; ultra-modern equipment installed for making repairs quickly and efficiently.

ELECTRIC SWITCHES

AUTOMATIC A.C. Automatic A.C. Network Switching Units, G. G. Grissinger. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 1, Jan. 1927, pp. 46-49, 5 figs. Desirable characteristics of automatic switching units designed for application in secondary a.c. distribution networks; units designed for wall mounting and for manhole installation.

ELECTRIC TRANSMISSION LINES

GROUND DETECTORS. Applying Ground Detectors to Control Circuits, R. B. Greenwood. Power, vol. 65, no. 2, Jan. 11, 1927, pp. 55-56, 4 figs. Common type of lamp ground detector contains possibilities of causing false operation of control apparatus; suggestions as to how these troubles may be prevented.

SLEET PREVENTION. Methods of Sleet Prevention. Nat. Elec. Light Assn.—Serial Report, no. 267-6, Nov. 1926, 4 pp., 1 fig. Information as to methods and equipment which have been used to prevent formation of sleet or ice on transmission-line wires.

ELECTRICAL MACHINERY

STABILITY CHARACTERISTICS. Stability Characteristics of Machines, R. D. Evans and C. F. Wagner. Elec. World, vol. 89, no. 3, Jan. 15, 1927, pp. 141-143, 2 figs. Low armature-leakage reactance and quick response in excitation desirable for synchronous machines used in long-distance high-power transmission systems.

TRAPEZOIDAL TEETH SECTIONS. A Graphical Determination of Ampere-Turns for Trapezoidal Teeth Sections, J. F. Calvert. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 1, Jan. 1927, pp. 57-58, 2 figs. Method applied to rotating electrical machines having rectangular slots and trapezoidal teeth sections.

ELECTRICITY SUPPLY

LINE EXTENSIONS. A Rational Method for Determining the Advisability of Making Line Extensions in Electric Public Utilities, H. G. D. Nutting. Nat. Elec. Light Assn.—Bul., vol. 13, no. 12, Dec. 1926, pp. 758-759 and 782. In paper read before Wis. Elec. Assn. in 1914, writer pointed out desirability of applying rational formula to problem; present paper contains further discussion of its use.

SUBURBAN LOAD. Characteristics of a Suburban Load, R. R. Herrman. Elec. World, vol. 88, no. 25, Dec. 18, 1926, pp. 1259-1262, 3 figs. Special reference made to experiences with load and diversity factors on range-loaded lines of new real estate development on outskirts of city; long secondary lines unavoidable necessity.

ELECTRIC WELDING, ARC

GAS-ELECTRIC CAR. "Alternarc" Gas-Electric Welding Car. Am. Mach., vol. 66, no. 1, Jan. 6, 1927, p. 35, 1 fig. Electric Arc Cutting and Welding Co., Newark, N.J., has brought out gas-electric drive, self-propelled welding car; consists of standard gas engine mounted in standard truck car; generator provides both alternating and direct current for arc welding.

OXIDATION OF ARC CRATER. Oxidation of the Arc Crater, P. Alexander. Am. Welding Soc.—Jl., vol. 5, no. 12, Dec. 1926, pp. 11-14. Discusses oxidation and nitrogenation of molten iron in crater of welding arc; study of relation of oxidation of surface of crater to number of gas pockets in solidifying metal.

ELEVATORS

CONTROLLERS. How Semi-Magnet Alternating-Current Elevator Controllers Operate, C. A. Armstrong. Power, vol. 65, no. 3, Jan. 18, 1927, pp. 94-97, 10 figs. Operation of controllers used on hand-rope operated machines and construction of magnetic contactors used in this class of service.

ENGINEERS

EXECUTIVE POSITIONS FOR. Qualifying Engineers for High Executive Positions, E. M. Herr, H. A. Guess, F. B. Jewett and J. C. Parker. Am. Soc. Civ. Engrs. —Proc., vol. 53, no. 1, Jan. 1927, pp. 38-52. Informal discussion presented at Joint Meeting of Metropolitan Sections of Founder Societies.

REGISTRATION. Present Status of Registration of Engineers, A. Richards. Eng. News-Rec., vol. 97, no. 26, Dec. 23, 1926, pp. 1028-1029. In 25 states having laws, 27,277 engineers and surveyors have registered, of whom majority are civil engineers.

EVAPORATION

RAPID-FLOW. A New High-Effect, Rapid-Flow Evaporator. Indus. Chemist, vol. 11, no. 23, Dec. 1926, pp. 551-552, 6 figs. Details of Vogelbusch patent evaporator; its method of operation is based chiefly on extremely high velocity with which liquid to be evaporated flows over heating surfaces, whereby exceptionally high specific transference of heat, as well as preservation of material in process is achieved.

F

FANS

CENTRIFUGAL. Operating Characteristics of Centrifugal Fans and Use of Fan Performance Curve. Am. Inst. Min. & Met. Engrs.—Advance Paper, no. 1626-A, Jan. 1927, 13 pp. Discussion of paper by L. W. Huber issued in pamphlet 1542-A, Feb. 1926.

MOTOR DRIVE FOR. Selecting the Motor Drive for Industrial Fans, G. Lee. Indus. Mgmt. (N.Y.), vol. 73, no. 1, Jan. 1927, pp. 56-60, 5 figs. Before selecting either fan or motor, every consideration should be given to choice of proper type of fan and to selection of right motor for driving it; deals with properties of fans and characteristics of different types of motors.

FATIGUE

INDUSTRIAL. Industrial Fatigue, G. H. Shepard. Soc. Indus. Engrs. Bul., vol. 8, no. 11, Nov. 1926, pp. 23-32, 1 fig. Particular problems of wide industrial importance; laboratory researches; variations in output and other tests of performance; comparison of shifts of different lengths; length of working week; physiological effects; effect of aggregation, illumination, sitting, etc.

FILTERS, SAND

CLEANING. Cleaning Philadelphia's Slow-Sand Filters Mechanically, G. G. Schaut. Am. Water Wks. Assn.—Jl., vol. 16, no. 6, Dec. 1926, pp. 685-704, 9 figs. Nichols scraper; Blaisdell type of filter washer and belt-thread filter washer; sand removal and conditions after washing; rate, loss of head, turbidity and bacteria removal; Blaisdell washers in their present design have given results anticipated by Philadelphia Water Bureau.

HEAD LOSSES. Head Losses in the Rapid Sand Filters at Cambridge, Mass., R. G. Tyler, W. A. Danielson and M. Lebosquet, Jr. New England Water Works Assn.—Jl., vol. 40, no. 3, Sept. 1926, pp. 322-344, 12 figs. Results of tests indicating conditions as they exist in plant under actual operating conditions.

FILTRATION PLANTS

ST. CATHARINES, ONT. St. Catharines, Ont., Has Model Water Filtration Plant. Contract Rec., vol. 40, no. 52, Dec. 29, 1926, pp. 209-211, 2 figs., and vol. 41, no. 1, Jan. 5, 1927, pp. 7-13, 9 figs. Review of conditions that led to decision to instal filtration facilities; plant has capacity of 10,000,000 gal., with filtered water reservoir of 5,000,000 gal. capacity as part of plant unit; clear-water reservoir is constructed of reinforced concrete; details of coagulating basins, filters, pipe gallery, etc.

FLOTATION

SYNTHETIC TESTING FOR. Synthetic Testing for Flotation, C. G. McLachlan. Can. Inst. Min. & Met.—Trans., vol. 29, 1926, 30 pp., 15 figs. Work undertaken with view to determining, if possible, relative importance of phenomena on which flotation seems to depend.

FLOW OF FLUIDS

VISCOUS FLUIDS. The Forces on a Cylinder in a Stream of Viscous Fluid, L. N. G. Filon. Roy. Soc.—Proc., vol. 113, no. A763, Nov. 1, 1926, pp. 7-27, 2 figs. Investigation to obtain formulas for lift and drag when solid cylinder is at rest in stream of viscous incompressible fluid, but no limitation is imposed upon magnitude of stream velocity.

The Laws of Similitude Applied to the Flow of a Viscous Fluid, M. Carmichael. Engineering, vol. 123, no. 3182, Jan. 7, 1927, pp. 27-30, 23 figs., partly on p. 26. Conclusions based on experiments, as follows: (1) Classification of phenomena existing downstream of submerged body makes it possible to avoid confusion between surface of discontinuity and phenomena of circulation; (2) there is no difference between motion of body through fluid and motion of fluid past body; (3) laws of similitude make it possible to reduce motion of any fluid to that of typical fluid of liquid type, and to deduce from observations made with water, properties of all other fluids; (4) laws of similitude hold good for viscous fluids under conditions which had not previously been studied. Translated from French.

FLOW METERS

ELECTRIC. An Improved Electric Flow Meter, T. R. Harrison. Optical Soc. of America & Rev. of Sci. Instruments—Jl., vol. 13, no. 6, Dec. 1926, pp. 731-738, 4 figs. Brown electrically-operated flow meter which avoids at one stroke electrical as well as mechanical difficulties previously encountered in flow meters. See also description in Eng. & Boiler House Rev., vol. 40, no. 6, Dec. 1926, pp. 303-308, 4 figs.

FLUE GASES

CORROSION BY. Corrosion of Flue Gases, A. G. Christie. Power, vol. 65, no. 3, Jan. 18, 1927, pp. 87-88. Corrosion by flue gases has been prevalent in plants that use coals or oils high in sulphur; it is generally recognized that it is due to oxidation of sulphur in fuel, not only to sulphur dioxide, but also to sulphur trioxide, which forms sulphuric acid on exposed surfaces.

FLUIDS

DENSITY. The Density of Fluids, J. H. Shaxby. London, Edinburgh & Dublin Philosophical Mag., vol. 2, no. 11, Nov. 1926, pp. 1127-1136. Relation between density and temperature and on latent heat of vaporization.

FLUMES

GUNITE. Gunite Bench-Flume for the Vista Irrigation District, K. Q. Volk. West. Constr. News, vol. 1, no. 23, Dec. 10, 1926, pp. 30-33, 8 figs. Bench-flume has inside width of 4 ft. 3 in. and depth of 3 ft. 2 in.; side walls are only 2 in. thick, reinforced with 4- by 4-in. No. 7 by No. 7 galvanized electrically-welded mesh.

FORGING

BOLT AND NUT. The Development of Bolt and Nut Forging, E. J. Wiley. Machy. (Lond.), vol. 29, no. 742, Dec. 30, 1926, pp. 430-434, 12 figs. History of development; Oliver machine; vertical-bolt press; rotary rivet machine; plunger-type tools; radial hammer machines; heading difficulties; use of bunting tools; reduction in bolt-head sizes.

FORGINGS

BRASS. Brass Forgings, O. J. Berger. Machy. (Lond), vol. 29, no. 742, Dec. 30, 1926, pp. 414-415. Finish and strength of forgings; composition of material; equipment for forging shop; preparing forging blank; dies for hot-pressed parts; and for drop and steam hammers; limits on forging dimensions; importance of correct heating.

FOUNDRIES

ENGINE CASTINGS. Standardize Practice in Engine Castings, P. Dwyer. Foundry, vol. 54, no. 22, Nov. 15, 1926, pp. 900-904, 7 figs. Methods and equipment in foundry of C. & G. Cooper Co., Mt. Vernon, O.; in preparing sand for use, etc.; mould and core ovens; types of moulding machines employed; setting cores.

FALLACIES AND PRACTICE. Some Fallacies in Foundry Practice. Metal Industry (Lond.), vol. 29, no. 23, Dec. 3, 1926, pp. 539-540. It is stated that cupola is most prolific source of misconceptions; arising mainly from fact that top of coke bed is actually first charge of coke; theories in connection with use of wet coke; many cupolas are worked inefficiently through application of too high blast pressure; effect of temperature on amounts absorbed.

PROGRESS, 1926. Refinements Mark Foundry Progress, D. M. Avey. Iron Trade Rev., vol. 80, no. 1, Jan. 6, 1927, pp. 26-27, 2 figs. In automotive foundries, use of power-driven, mould-conveying equipment with gravity-roller conveyor tables for return of idle flasks, bottom boards and sundries has become practically standard; improved methods of sand preparation and sand handling; tendency in cast-iron pipe shops has been toward general adoption of centrifugal-casting methods; adoption of preheating cupola of advanced design, in which gases are taken out of stack above melting zone, conducted through tubes of preheating chamber; application of electric furnaces.

FUEL ECONOMY

STEEL INDUSTRIES. Fuel Economy in the Steel Industry, H. A. Bassert. Blast Furnace & Steel Plant, vol. 14, no. 12, Dec. 1926, pp. 502-504 and 512. Possibilities of fuel economy in iron and steel industry; American and German practice compared; output and labour-saving first in American plants. Paper presented at Int. Conference on Bituminous Coal.

FUELS

COAL. *See Coal; Pulverized Coal.*

OIL. *See Oil Fuel.*

PRODUCTION AND UTILIZATION. Production of Fuels and Their Utilization. Power, vol. 65, no. 1, Jan. 4, 1927, pp. 14-18, 3 figs. Interest in processing of coal is increasing; water-cooled walls, smaller furnaces, unit mills, turbulent burners and improved driers are feature in pulverized-coal field.

PULVERIZED COAL. *See Pulverized Coal.*

FURNACES, ANNEALING

OIL-BURNING. Oil-Burning Annealing Furnaces, C. C. Hermann. Machy. (N.Y.), vol. 33, no. 5, Jan. 1927, pp. 357-358, 3 figs. Use of oil as heating medium in annealing furnaces employed in malleable-iron industry; details of oil burner; packing castings in annealing pots; annealing operation.

FURNACES, INDUSTRIAL

DESIGN. Industrial Furnaces, C. Longenecker. Iron Trade Rev., vol. 79, nos. 10, 14, 16, 18, 20, 22, 24 and 26, Sept. 2, 30, Oct. 14, 28, Nov. 11, 25, Dec. 9 and 23, 1926, pp. 568-571, 843-845, 981-983, 1106-1108, 1231-1233, 1355-1357 and 1361, 1496-1498 and 1625-1627, 35 figs. Treatise on design, construction and function of modern melting, heating and treating units; intermediate or heating furnaces; reheating or finishing furnaces.

Practical Industrial Furnace Design, M. H. Mawhinney. Forging—Stamping—Heat Treating, vol. 12, no. 12, Dec. 1926, pp. 470-474, 5 figs.; vol. 13, no. 1, Jan. 1927, pp. 2-8 and 11, 3 figs. December: Historical development; fuels for industrial heating, present-day conditions and problems in selecting, buying and designing furnaces. January: Latest methods of utilizing various fuels for industrial furnaces; comparative costs of fuels.

G

GAUGES

ANGULAR-FORM. The Manufacture and Measurement of Angular-Form Gauges, E. A. Swift. Machy. (Lond.), vol. 29, no. 738, Dec. 2, 1926, pp. 265-268, 14 figs. Methods employed by author which have proved satisfactory.

TYPES. A Machine Shop Gauge for Every Job, F. Horner. Can. Machy., vol. 36, no. 27, Dec. 30, 1926, pp. 170-172, 13 figs. Points out that types of anvils and measuring surfaces and their mode of application vary widely; ordinary gauges now being superseded, in difficult screw-thread work, by intervention of accurately-finished wires.

GALVANIZING

SPRAYING PROCESS. Spraying Metal. Engineer, vol. 142, no. 3700, Dec. 10, 1926, p. 632. Process developed by Schoop and its general adaptability; spraying is carried out by means of pistol into which there is fed wire of metal to be sprayed.

GASOLINE

INVESTIGATIONS. Investigations of Automobile Fuels, P. H. Comradson. Oil & Gas Jl., vol. 25, no. 28, Dec. 2, 1926, p. 111. Apparatus and methods for determination of solid residue, volatility and unsaturates in modern gasoline.

GEARS

RAILWAY TRACTION. Railway Traction Gears and Pinions. Ry. Engr., vol. 48, no. 564, Jan. 1927, p. 6. Outlines experience of Southern Railway; gears and pinions were manufactured by Cincinnati Tool Steel & Pinion Co., U.S.; they are extremely accurate in all respects; author points out that extreme accuracy, which may be keynote for stationary machinery and motor cars, is not necessarily most suitable standard for railway-traction work.

GRINDING

REGRINDING PRACTICE. Outline Regrinding Practice, J. F. Pflum. Abrasive Industry, vol. 7, nos. 10 and 11, Oct. and Nov. 1926, pp. 312-314 and 342-343. Various experts give data from actual practice; cylinder grinding has followed automotive production closely.

STELLETS. Grinding of Stellite Tools. Abrasive Industry, vol. 7, nos. 7, 8, 9 and 10, July, Aug., Sept. and Oct. 1926, pp. 215-218, 249-250, 281-282 and 309-311, 34 figs.

GRINDING MACHINES

CRANKPIN. The New Landis Crankpin Grinder. Automobile Engr., vol. 16, no. 223, Dec. 1926, p. 499, 1 fig. Machine embodying hydraulic feed drive and clamping mechanism.

H

HARDNESS

BALL AND CONE TESTS. Hardness Tests Research. Machy. (Lond.), vol. 29, no. 742, Dec. 30, 1926, pp. 424-426, 1 fig. Report on diamond-cone indentation hardness tests; tests with various cones; comparison of results with other hardness tests; investigation shows that diamond cones can be used for accurate and reliable indentation tests on hard materials, and when results are corrected for adhesion or friction, direct comparison can be made with steel cone or ball test results on softer materials. (Abstract.) Paper read before Instn. Mech. Engrs.

SCLEROSCOPE TEST. Methods of Hardness-Testing. Am. Mach., vol. 65, no. 26, Dec. 23, 1926, p. 1041, 3 figs. Scleroscope and its use; reference-book sheet.

HEAT TRANSMISSION

EQUATIONS. Rules for Heat Transmission (Regole sintetiche sulla trasmissione del calore), A. Sellerio. Industria, vol. 40, no. 18, Sept. 30, 1926, pp. 478-479, 1 fig. Refers to article by Praetorius in Archiv für Wäarmewirtschaft, p. 199, 1926, suggesting that term "conductivity" in transmission through walls be dropped and term "resistance" be substituted, resulting in more simple and clear equations; author approves this change and explains resulting changes in calculation.

RADIATION. The Radiation and Convection of Heat, T. Barrett. Eng. & Boiler House Rev., vol. 40, no. 7, Jan. 1927, p. 369-373, 3 figs. Laws of radiation and convection; experiments by author have shown that amount of heat lost from surface at given temperature excess over its surroundings depends not only on area of surface exposed and on its temperature, but also on shape and disposition of surface; results of experiments apply to practical engineering problems, such as insulation of furnaces, boiler pipes, refrigeration chambers, etc., and transmission of heat in water tube boilers.

TURBULENCE AND. Turbulence and Heat Transfer, L. G. Bousquet. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 1, Jan. 1927, pp. 29-36, 5 figs. Presents data showing effect of kind of air flow set up by fan on rate of heat transfer of two types of indirect heaters, namely, cellular and fin and tube types.

HEATING AND VENTILATION

HOTELS. Design and Operation of Hotel Heating and Ventilating Systems, B. Natkin. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 1, Jan. 1927, pp. 11-22, 5 figs. System installed in Hotel President, Kansas City; details of power plant, steam and ventilating systems.

HEATING, ELECTRIC

RESIDENCES. Heating Residences with Electricity, A. S. L. Barnes. Can. Engr., vol. 51, no. 23, Dec. 7, 1926, pp. 695-696. General use not commercially feasible; from investigations made by Ontario Hydro-Electric Power Commission and discussed in symposium on Heating Residences presented at recent meeting of Ontario Section, A.S.M.E., Toronto.

HEATING, HOT-AIR

FORCED-AIR FURNACE. Forced-Air Furnace Heating, A. M. Daniels. Sheet Metal Worker, vol. 17, no. 24, Dec. 31. 1926, pp. 967-969 and 1005, 4 figs. Principles of design in furnace-fan heating systems; results of tests at University of Illinois.

PIPE SIZES. Estimating Warm-Air Pipe Sizes. Sheet Metal Worker, vol. 17, no. 24, Dec. 31, 1926, pp. 964-966, 3 figs. Practical demonstration of application of standard code method.

HEATING, STEAM

ATMOSPHERIC SYSTEM. Typical Steam Heating Installation Using the Atmospheric System, T. F. Moffet. Plumbers' Trade Jl., vol. 82, no. 1, Jan. 1, 1927, pp. 48-50, 6 figs. Treating fundamental design which has demonstrated its excellent heating efficiency and proved value of equipment of simplified type.

RADIATOR FINISHES. Comparative Tests of Radiator Finishes, W. H. Severns. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 1, Jan. 1927, pp. 23-28, 3 figs. Concludes from investigation that certain standard finish must be made basic standard of comparison for tests of radiator finishes; colour, chemical composition of finish pigments, and vehicle used to carry pigments of basic finish must be defined, if comparative results are to be useful and easily understood; reduction of heat transmitted by radiator coated with aluminum bronze is not as much as 25 per cent, as widely reported for all classes of radiators, but that it may range from 18 per cent for special and very effective radiators down to 9 per cent or less for wider and higher, column-type, steam radiators.

VACUUM. Vacuum Heating, C. A. Thinn. Universal Engr., vol. 44, no. 6, Dec. 1926, pp. 20-23, 4 figs. Advantages of vacuum heating system are: economical use of fuel; use of minimum pipe sizes; it gives partial temperature regulation; eliminates air valves on radiators; makes possible use of exhaust steam with minimum back pressure on engine; is positive in circulation; requires low initial steam pressure; has quick circulation, etc.

HIGHWAYS

PROBLEMS AND PRACTICE. An Examination of Highway Problems and Practice. Eng. News-Rec., vol. 98, no. 1, Jan. 6, 1927, pp. 4-5. Editorial review; engineering design; larger planning problems; maintenance methods, grade-crossing elimination; foreign roads.

HOUSES

STEEL. The House of To-morrow Made Fireproof and Permanent by Steel, R. T. Mason. Iron Trade Rev., vol. 79, no. 26, Dec. 23, 1926, pp. 1616-1617 and 1621, 4 figs. Review of attempts to develop use of steel in domestic dwelling construction for increasing permanency and fireproof qualities; example of high-class dwelling being built in Cleveland.

HYDRAULIC TURBINES

IMPULSE. Hydraulic Turbine to Operate Under Nearly One-Half Mile Head. Power, vol. 65, no. 3, Jan. 18, 1927, pp. 82-85, 7 figs. Largest impulse-wheel unit ready for operation under highest head so far utilized in United States; water-jet over 7 in. in diameter with velocity of 370 ft. per sec.; governing of unit and safety devices provided of special interest; installed at San Joaquin Light & Power Corp., Fresno, Cal.

HYDRO-ELECTRIC DEVELOPMENTS

ST. LAWRENCE RIVER. The St. Lawrence Power Development. Contract Rec., vol. 40, no. 50, Dec. 15, 1926, pp. 1189-1191. Answers to 11 specific questions contained in instructions to Joint Board of Engineers; supplementary information to that published in Contract Rec. of Dec. 1.

UNITED STATES, 1926. Water Power Development 11,176,596 H.P. Elec. World, vol. 89, no. 1, Jan. 1, 1927, pp. 51-52, 2 figs. Third of available power in United States now harnessed; 83 per cent on public-utility plants.

Water-Power Development Active. Power, vol. 65, no. 1, Jan. 4, 1927, pp. 25-28, 8 figs. One of outstanding major projects in St. Lawrence; installation of 8 units in Muscle Shoals plant, totalling 260,000 h.p., was completed during year; outstanding project from point of size on which work was started is Conowingo; other developments.

HYDRO-ELECTRIC PLANTS

ARGENTINE. The Power Station Cachueta in Argentina. Eng. Progress, vol. 7, no. 12, Dec. 1926, p. 336, 2 figs. Station in Province of Mendoza utilizes head of 42m. obtained by cutting off loop of Mendoza River and artificial damming of river.

FRANCE. Hydro-Electric Plant in Chancy-Pougny) (L'usine génératrice hydroélectrique de Chnacy-Pougny), M. Barrere. Revue Génerale de Electricité, vol. 20, no. 18, Oct. 30, 1926, pp. 633-641, 12 figs.

The Chancy-Pougny Hydro-Electric Plant (L'usine génératrice hydro-électrique de Chancy-Pougny), J. Reyval. Revue Génerale de l'Electricité, vol. 20, no. 7, Aug. 14, 1926, pp. 250-254, 8 figs.

ITALY. Statistics of Water Utilization as Motive Power (Statistica delle grandi utilizzazioni idrauliche per forza motrice), A. Rampazzi. Annali dei Lavori Pubblici, vol. 64, no. 8. Aug. 1926, pp. 653-658.

MARYLAND. Construction of Great Water Power Plant Well Under Way. Eng. News-Rec., vol. 97, no. 27, Dec. 30, 1926, pp. 1024-1026, 5 figs. Conowingo hydro-electric project on Susquehanna River to be second only to Niagara in initial installation; dam to be 4,800 ft. long.

QUEBEC. The Construction of the Isle Maligne Power Plant, Quebec. Engineering, vol. 122, no. 3179, Dec. 17, 1926, pp. 747-750, 9 figs., partly on supp. plate. Details of one of two stations which will have combined capacity of over 1,000,000 h.p., some of which will be used for papermaking; present plant consists of power house in which eight 45,000-h.p. units have been installed.

REMOTE CONTROL. Hanna Chute Plant for Ontario Hydro on Georgian Bay System. Elec. News, vol. 35, no. 24, Dec. 15, 1926, pp. 27-29, 2 figs. Operated entirely by remote control from neighbouring generating station; vertical generator, spring-type thrust bearing, propeller-type turbine.

SWEDEN. Lilla Edet Central Station (Lilla Edets Kraftverk), E. Millen. Teknisk Tidskrift (Allamänna Ardelningen), vol. 56, nos. 36 and 38, Sept. 4 and 18, 1926, pp. 329-336 and 345-348, 18 figs. Details of construction; dams and reservoir; machinery building; Kaplan turbine of 5.8m. diameter and Lawaczeck turbines of 6m. diameter; direct coupled generators of 10,000 to 11,000 volt for 10,000-kva. 3-phase current, etc.

I

ILLUMINATION

MEASUREMENTS. Illumination Measurements. Engineering, vol. 122, no. 3180, Dec. 24, 1926, pp. 774-777, 12 figs. Review of three reports, by Committee of Scientific and Industrial Research Department, on present terminology used in study of illumination, results of measurements made on transmission of light through cast- or rolled-plate glass, and distribution of light by type of industrial reflector.

INDUSTRIAL MANAGEMENT

PRODUCTION CONTROL. Systematic Control of Production, C. O. Herb. Machy. (N.Y.), vol. 33, no. 5, Jan. 1927, pp. 345-349, 10 figs. How work is effectively routed through large plant building woodworking machinery.

SMALL PLANTS. Management Problems in the Small Plant, H. P. Wherry. Mfg. Industries, vol. 12, nos. 3, 4, 5 and 6, Sept., Oct., Nov. and Dec. 1926, pp. 207-210, 257-260, 355-358 and 4 9-422. Sept.: Factors which experience proves are most important for successful business operation. Oct.: Difficulties to be met and overcome in organizing and operating sales and production activities. Nov.: Equipment, production control, costs, material handling and packing methods require special executive supervision. Dec.: Building organization and establishing financial control.

TIME STUDY. *See Time Study.*

WASTE ELIMINATION. Management's Part in Waste Elimination, H. V. Coes. Soc. Indus. Engrs. Bul., vol. 8, no. 11, Nov. 1926, pp. 3-8. Advantages of budget; modern business ailments and ailment indicators; presents summary of concrete studies management should initiate.

Reducing Waste in Management, T. D. Nevins. Soc. Indus. Engrs. Bul., vol. 8, no. 11, Nov. 1926, pp. 21-22. Case where waste was reduced by established co-ordination between sales and office.

INDUSTRIAL PLANTS

LOCATION. Six Major Factors in Plant Location, H. S. Colburn. Mfg. Industries, vol. 12, no. 6, Dec. 1926, pp. 409-4 2. Discusses important changes introduced by modern industrial conditions; influence of aviation; incoming competition.

INDUSTRIAL RELATIONS

CHANGING CONDITIONS. The Changing Relations Between Employer and Employee, W. L. Abbott. Mech. Eng., vol. 49, no. 1, Jan. 1927, pp. 17-20. Growth of corporation; newer understanding between employer and employee; conditions in building trades and coal industry; dawn of new order and part of engineer therein.

INDUSTRY

CREDIT FACTOR AND. The Credit Factor in the Structure of Industry, D. R. Dewey. Mech. Eng., vol. 49, no. 1, Jan. 1927, pp. 12-15. New uses and expansion of credit as dominating characteristic of present century; modern forms of credit; instalment buying; credit as remedy for economic and social ills. Henry Robinson Towne lecture on Relation between Engineering and Economics.

INSULATION HEAT

THEORY AND PRACTICE. Modern Insulation Theory and Practice, G. Y. Pitts and J. Hatton. Ice & Cold Storage, vol. 29, no. 345, Dec. 1926, p. 321. Review of two papers read before North-Western Section of Brit. Cold Storage and Ice Assn.; area of insulation; overall cost of refrigeration; temperature rise with machinery standing; variation of conductivity.

INSULATORS, ELECTRIC

RUPTURE. Insulation Theory Spinning, F. Fernie. World Power, vol. 7, no. 37, Jan. 1927, pp. 31-33. Elaborates thesis that puncture of electrical insulation depends on two distinct characteristics of material; first is defined by value of breakdown voltage when pressure is quickly raised; second is breakdown value when time element is taken into account, and is widely different from first.

INTERNAL-COMBUSTION ENGINES

VIBRATIONS IN SHAFTS. The Properties of Torsional Vibrations in Reciprocating Engine Shafts, G. R. Goldsborough. Roy. Soc.—Proc., vol. 113, no. A764, Dec. 1, 1926, pp. 259-271, 1 fig.; also (with H. Baker) pp. 272-281, 9 figs. Pp. 272-281: Torsional vibrations in shaft; examines effect of reciprocating parts in producing or modifying vibrations; for this purpose model is proposed which is as simple as can be conceived, and which at same time involves characteristics of reciprocating motion. Pp. 272-281: Summary of torsional effects which appear with variation in speed.

See also Airplane Engines; Automobile Engines; Diesel Engines; Oil Engines.

IRON

STAINLESS. The Tensile Properties of Stainless Iron and Other Alloys at Elevated Temperatures, P. G. McVetty and N. L. Mochel. Am. Soc. Steel Treating, vol. 11, no. 1, Jan. 1927, pp. 73-93 and (discussion) 93-100 and 169, 18 figs.

IRON ALLOYS

BRINELL BALLS. Iron-Carbon-Vanadium Alloys for Brinell Balls, G. W. Quick and L. Jordan. Am. Soc. for Steel Treating—Preprint, no. 3, for mtg. Jan. 20-21, 1927, 22 pp., 5 figs. Special alloy of about 2.9 per cent carbon and 13 per cent vanadium has been experimentally used for Brinell balls in testing of steels of such hardnesses as cause ordinary Brinell balls to deform both elastically and plastically.

IRRIGATION

SEWAGE, WITH. Irrigation with Treated Sewage in Western Texas, H. N. Roberts and D. L. Jones. Eng. News-Rec., vol. 97, no. 26, Dec. 23, 1926, pp. 1026-1028, 3 figs. Effluent from tanks and sprinkling filters of Lubbock pumped to reservoir and used on cotton and other crops.

J

JETTIES

PRECAST BLOCKS. Jetties of 5- to 10-Ton Precast Blocks Built in Florida, K. Bryan. Eng. News-Rec., vol. 97, no. 26, Dec. 23, 1926, pp. 1030-1032, 4 figs. Protect ocean end of newly-dredged channel which will aid in clearing sewage from Lake Worth.

L

LIFTING MAGNETS

ELECTRIC. Electric Lifting Magnets. Elecn., vol. 97, no. 2535, Dec. 31, 1926, pp. 758-759, 4 figs. Design and constructional details; methods of coil winding and insulation; impregnating procedure.

LIGHTING

STREET. Chicago Sets a New Standard in Street Lighting, S. W. Thompson. Elec. World, vol. 88, no. 26, Dec. 25, 1926, pp. 1311-1312, 3 figs. High-intensity illumination on State Street necessitates development of new type of lamp; simple control method reduces costs.

The Remote Control of Multiple-Street Lighting, W. T. Dempsey. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 1, Jan. 1927, pp. 12-16, 7 figs. Describes control systems for multiple-street lighting systems and deals particularly with systems employed in New York City.

A Review of Twenty Years of Street Lighting Development, P. S. Millar. Illum. Eng. Soc.—Trans., vol. 21, no. 10, Dec. 1926, pp. 1106-1113. Statement of change in levels of illumination now as compared with 1906; advances in large illuminants, though considerable, have not been of fundamental importance in street lighting; in matter of levels, industry is woefully behind requirements of present-day situation.

LOCOMOTIVES

DEVELOPMENTS. 1926. An era of Intensive Locomotive Development. C. B. Peck. Ry. Age, vol. 82, no. 1, Jan. 1, 1927, pp. 49-53, 7 figs. Baldwin high-pressure test data: future of high-steam pressures; Diesel locomotives; trend of European developments; passenger-car and freight-car developments; use of lacquers.

ELECTRIC. *See Electric Locomotives.*

EXPRESS. 2C1 Standard Express Locomotive of the German State Railway (2C1-Einheits-Schnellzuglokomotive der Deutschen Reichsbahn), D. F. Fuchs and D. R. P. Wagner. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 52, Dec. 25, 1926, pp. 1725-1744, 50 figs. Principles governing design and construction of standard locomotives; influence of standardization; details of express locomotive built as 4-cylinder compound and as 2-cylinder locomotive.

INTERNAL-COMBUSTION. Internal-Combustion Locomotives for Railway and Industrial Purposes. Ry. Engr., vol. 48, no. 564, Jan. 1927, pp. 16 and 27, 2 figs. Two useful types manufactured by Crossley Bros., designed for switching about factory premises and yards.

SUPERHEATING. Modern Locomotive Superheating, H. E. Geer. Ry. Gaz., vol. 45, no. 26, Dec. 24, 1926, pp. 755-756 and (discussion) 767. Superheat characteristics; position of regulator; impeding efficiency. (Abstract.) Paper read before Instn. Locomotive Engrs.

WHEEL ARRANGEMENTS. Locomotive Types: The Economics of Wheel Arrangement. Oriental Engr., vol. 7, nos. 1 and 2, Mar. and Apr. 1926, pp. 13-21 and 25-35, 10 figs. There are 27 different wheel arrangements among 1,148 locomotives on government railways; consideration of what types are good; how to choose best types to meet specific conditions.

LUBRICATING OILS

CLEANING. Lubricants: The Cleaning of Dirty Oil, A. Seton. Machy. (Lond.), vol. 29, no. 742, Dec. 30, 1926, p. 413. Points out that installation of recovery plant is very desirable when annual consumption of oil is high, and savings effected certainly more than balance interest on capital outlay involved.

LUMBER

SIMPLIFIED-PRACTICE RECOMMENDATION. Lumber. U.S. Dept. of Commerce—Simplified-Practice Recommendations, no. 16, July 1, 1926, 91 pp., 28 figs. Lumber classifications; nomenclature of commercial softwoods; yard lumber; structural material; softwood factory and shop lumber; lumber-inspection provisions and service; lumber abbreviations; brief history of standardization.

M

MACHINE SHOPS

HEAVY MACHINERY. Workshop Methods in Heavy Engineering, H. I. Brackenbury and W. J. Guthrie. North-East Coast Instn. Engrs. & Shipbldrs.—Advance Paper, Dec. 10, 1926, 11 pp., 3 figs.

MACHINE TOOLS

DESIGN. The Trend of Machine Tool Design. Machy. (Lond.), vol. 29, no. 740, Dec. 16, 1926, pp. 321-322. Developments of importance to users of machine tools.

MACHINERY

WELDED-STEEL VS. CAST-IRON PARTS. 50 Per Cent Cost Reduction in Machine Parts, R. E. Kinkead. Mfg. Industries, vol. 12, no. 6, Dec. 1926, pp. 423-424, 5 figs. Claims use of welded steel instead of grey-iron castings for machinery bases, frames and other parts, offers effective method of reducing manufacturing costs.

MAGNESIUM

PROPERTIES. Notes on Magnesium and Its Alloys, W. R. D. Jones. Roy. Aeronautical Soc.—Jl., vol. 30, no. 192, Dec. 1926, pp. 743-761 and (discussion) 761-771; also abstract in Am. Metal Market, vol. 33, no. 242, Dec. 18, 1926, pp. 8-11 and 26. Review of developments; presents table of physical properties of magnesium which are compared with those of other pure commercial metals; in cast state magnesium is stronger than aluminum, but is weaker than other metals; properties are greatly improved by forging, becoming very much superior to those of forged aluminum; alloys of magnesium; comparison of steel and duralumin with elektron; zinc-magnesium, aluminum-magnesium, copper-magnesium alloys; dow metal; founding of magnesium and its alloys.

MALLEABLE IRON

ANNEALING. Continuous Annealing of Malleable Iron, G. Blakney. Fuels & Furnaces, vol. 5, no. 1, Jan. 1927, pp. 79-82 and 90, 5 figs. Continuous malleable kiln 195 ft. long, operating on 120-hour cycle, anneals 25 tons of castings per day; kiln is gas-fired and is equipped with automatic temperature control.

Notes on Annealing Blackheart Malleable, C. Kluijtmans. Foundry Trade Jl., vol. 34, no. 540, Dec. 23, 1926, pp. 550-554, 19 figs. Overheated, under-annealed, over-annealed and burnt iron; metallurgical reactions; annealing defects; overheated bars; cooling range.

MAPPING

TOPOGRAPHIC. Topographic Mapping and Its Relation to Revival of Western Mining, C. H. Birdseye. Min. Congress Jl., vol. 12, no. 12, Dec. 1926, pp. 857-859, 2 figs. Points out that research combined with topographic mapping will be basis upon which mining industry of future rests; Western States show very small percentage of area mapped.

MATERIALS HANDLING

CEMENT INDUSTRY. Materials Handling Problems in the Cement Industry, E. J. Tournier. Indus. Mgmt. (N.Y.), vol. 73, no. 1, Jan. 1927, pp. 17-23, 16 figs. Points out that cement manufacture to-day is less problem of making than of handling, and what has made possible huge production of Portland cement is highly-specialized machinery which accomplishes this handling in most economical way; developments in conveying equipment.

METAL DRAWING

NECK-DRAWING OPERATIONS. Dies Draw Supply-Tank Body to Shape, F. W. Curtis. Am. Mach., vol. 65, no. 27, Dec. 30, 1926, pp. 1065-1067, 10 figs. Sequence of operations and dies required to form shell; type of die used for 6 neck-drawing operations; air-operated mandrel used for threading.

METALS

PLASTICITY. On the Plasticity of Metals, H. Shôji. Tôhoku Imperial Univ.—Science Reports, vol. 15, no. 4, Oct. 1926, pp. 427-442, 26 figs. Definition of plasticity of metals; apparatus for experiments; results of experiments at room temperatures; new definition is proposed for plasticity. (In English.)

On the Plasticity of Metals at High Temperatures, H. Shôji and Y. Mashiyama. Tôhoku Imperial Univ.—Science Reports, vol. 15, no. 4, Oct. 1926, pp. 443-447, 6 figs. Plasticity of lead, tin and cadmium have been measured at various temperatures. (In English.)

SPECIFIC HEAT. Specific Heat of Metals at Low and at Very High Temperatures (Chaleur spécifique dês métaux aux basses et aux très hautes temperatures), G. Moressée. Revue Universelle des Mines, vol. 12, no. 6, Dec. 5, 1926, pp. 217-239, 1 fig. Ultra-violet waves characteristic of metals; rotational energy of atoms; total atomic mechanical energy; applications to lead and silver; investigation to determine specific heats in function of temperature.

X-RAY EXAMINATION. Examining Metals by Means of X-Rays (Genomlysning av metaller medelst röntgenstralar), J. Härdén. Teknisk Tidskrift (allmänna Ardelningen), vol. 56, no. 37, Sept. 11, 1926, pp. 337-340, 8 figs. Methods of examining semi-finished products, such as nickel, chrome and tungsten steels, for structural and other defects, and most recent X-ray tubes used.

METHANOL

SYNTHETIC. Synthetic Methanol and Liquid Fuels from Coal, G. Patart. Tech. Eng. News, vol. 7, no. 6, Dec. 1926, pp. 260-262, 288 and 290, 4 figs. Details of process developed by author; first experiments on catalytic reaction under high pressure; methanol production by high-pressure catalysis; chemical and mechanical realization of synthesis of alcohol. Paper read before Int. Coal Conference, Pittsburgh.

MOTOR-BUS TRANSPORTATION

DEVELOPMENTS. The Motor Bus as a Means of Highway Transportation, C. W. Stocks. Eng. News-Rec., vol. 98, no. 2, Jan. 13, 1927, pp. 80-83, 4 figs. Growth and development with figures as to present-day operation; industry regulated in 38 States and not tax-free; outlook for future.

MOTOR BUSES

DEVELOPMENTS, 1926. Bus Development Continued Steadily. Elec. Ry. Jl., vol. 69, no. 1, Jan. 1, 1927, pp. 33-39, 1 fig. Number of electric railways engaged in bus operation increased approximately 20 per cent during 1926, while number of buses increased more than 40 per cent; much new route mileage added; replacement of rail service comparatively slight; large purchases made of other automotive equipment.

O

OIL

PROSPECTING. Geophysical Methods in Oil Prospecting. Oil Eng. & Technology, vol. 7, no. 128, Dec. 1926, pp. 501-503, 2 figs. Apparatus and methods for investigating underground strata; seismic, magnetic, geothermic and radioactive methods; torsion-balance problems.

OIL ENGINES

AIRLESS-INJECTION. A Survey of Modern Airless-Injection Oil Engines, N. J. Griffin. Jr. Instn. Engrs., vol. 37, Nov. 1926, pp. 45-76, 22 figs. Considers engines of 2-stroke and 4-stroke cycles; attempt is made to discriminate as to cases in which one might prove more suitable than other.

APPLICATIONS. Oil Engines in Many Fields. Power, vol. 65, no. 1, Jan. 4, 1927, pp. 23-24, 4 figs. Central stations continue to purchase Diesels for isolated stations; increase in export business due to developments in South American oil fields; several railroads have purchased oil-engine locomotives for both branch- and main-line services.

OIL FUEL

BURNERS. Improvement in Oil Burners, E. H. Peabody. Power, vol. 65, no. 3, Jan. 18, 1927, pp. 109-110, 3 figs. Wide-range return-line system lends itself admirably to idea of putting control of fires in one place, where proper instruments for observing operating conditions may also be installed. Abstract of paper presented before Am. Petroleum Inst.

DIESEL OIL. Diesel Oil (Treiböl), H. Kühl. Petroleum, vol. 22, no. 26, Sept. 10, 1926, pp. 977-983, 2 figs. Water content of Diesel oils should not exceed 1 per cent, oil should still be liquid at 5 deg., or, in case of coal-tar oil, nothing should separate out at 15 deg.; in general, viscosity should not exceed 3 deg. Engler at 20 deg.; merits of oil from petroleum, lignite and coal, and low-temperature carbonization, and probable duration of petroleum supply. See brief translated abstract in Chem. & Industry, vol. 45, no. 48, Nov. 26, 1926, p. 93.

SELF-IGNITION. Experiments on Self-Ignition of Liquid Fuels, K. Neumann. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 391, Dec. 1926, 25 pp., 15 figs.

SUBMERGED COMBUSTION. Submerged Combustion of Liquid Fuels. Oil Eng. & Technology, vol. 7, no. 128, Dec. 1926, pp. 519-521. New development in efficient extraction of heat from fuel; Hammond system.

OIL SHALES

DEVELOPMENT. Present Activities in the Oil Shale Industry, V. C. Alderson. Min. Congress Jl., vol. 12, no. 12, Dec. 1926, pp. 864-869, 7 figs. Gasoline from shale oil; methods of mining; retorts; developments in Colorado, Kentucky, California, Nevada and Wyoming.

OPEN-HEARTH FURNACES

DESIGN. Development of Open-Hearth Design, C. Longenecker. Blast Furnace & Steel Plant, vol. 14, no. 12, Dec. 1926, pp. 526-529, 2 figs. Development of open-hearth from inception and various types of regenerative steel-melting furnaces reviewed; principles and operation.

ORDNANCE

RECOIL-CYLINDER GROOVING. Planing Devices for Grooving Recoil-Cylinders, F. H. Colvin. Am. Mach., vol. 66, no. 1, Jan. 6, 1927, pp. 3-4, 5 figs. How throttling grooves in recoil cylinders for gun carriages of various kinds are planed to desired size and contour at Watertown Arsenal.

OSCILLOGRAPHS

CATHODE-RAY. Frequency Measurements with the Cathode-Ray Oscillograph, F. J. Rasmussen. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 1, Jan. 1927, pp. 3-12, 17 figs. Cathode-ray oscillograph frequency measurement circuit, which differs from previous circuits in use of by-pass condensers and plate leaks which permit connection of oscillograph to a.c. circuits having large d.c. components and which permit use of biasing controls for shifting position of patterns on screen.

OXY-ACETYLENE WELDING

BRONZE. Bronze Welding Applications, W. C. Swift. Welding Engr., vol. 11, no. 12, Dec. 1926, pp. 26-28. Developments in use of bronze welding in repair and production. Paper read before Int. Acetylene Assn.

P

PAPER MANUFACTURE

BLEACHING. Bleaching Practice in North America, J. d'A. Clark. Paper Trade Jl., vol. 83, no. 27, Dec. 30, 1926, pp. 39-40. High-density bleaching; use of liquid chlorine for bleaching solution; electrolytic plants; waste-paper treatment; trouble with foaming. Abstracted from World's Paper Trade Rev., Nov. 26, 1926.

Groundwood Stocks. The Freeness of Groundwood Pulp, D. S. Davis. Indus. & Eng. Chem., vol. 19, no. 1, Jan. 1927, pp. 84-86, 4 figs. Presents data showing that increasing consistency decreases freeness (rate of drainage) of groundwood stocks in manner similar to that for sulphite stocks and that mathematical relationship between consistency and freeness is same for two stocks; presents chart which enables freeness values determined at one consistency to be converted to freeness at other consistencies.

Soda and Sulphate Processes. The Soda and Sulphate Processes, J. d'A. Clark. Paper Trade Jl., vol. 83, no. 25, Dec. 16, 1926, pp. 45-49. Main object of soda process is to get maximum yield of fibre which can be economically bleached; conversion costs of soda pulp; in sulphate, process yield is higher and conversion costs are rather lower than soda process.

Sulphite Pulp. Effect of Temperature Upon Freeness of Sulphite Pulp, D. S. Davis. Indus. & Chem., vol. 19, no. 1, Jan. 1927, pp. 162-165, 5 figs. Effect is accounted for almost entirely by viscosity of suspending medium; data given shows that freeness-consistency chart of previous paper, intended for use at 20 deg. cent., is applicable at other temperatures between consistencies of 0.35 and 0.45 per cent.

PAPER MILLS

Roof Construction. Roof Construction in Paper Mills, G. D. Bearce. Paper Mill, vol. 49, no. 52, Dec. 25, 1926, pp. 16 and 37. Correct type of roof must be either material that has high insulating value or combination of concrete or similar roof with some insulating material such as cork, celotex, balsam, wool, etc.

PATENTS

Copyright Law, vs. Patent vs. Copyright Law for Industrial Designs, J. D. Myers. Engrs. & Eng., vol. 43, no. 12, Dec. 1926, pp. 318-320. Substitution of copyright for patent protection for designs, and repeal of design patent laws is basic change embodied in legislation officially known as H.R. Bills 6249 and 13117; author discusses far-reaching effects of this change, which, he claims, will not be to encourage production of industrial designs; it is distinctly a step backward, and against public interests.

PIPE, CAST-IRON

Centrifugally Cast. Cast Iron Pipe, D. M. Avey. Foundry, vol. 54, no. 24, Dec. 15, 1926, pp. 972-977, 8 figs., and vol. 55, no. 1, Jan. 1, 1927, pp. 511, 9 figs. Birmingham, Ala., establishment has built and put into operation first commercial centrifugal cast-iron pipe plant using moulds lined with green sand; plan continuous operation. Jan. 1: Comprehensive sand-preparation and conveying system supplies moulding machines; sand layer is reamed from around poured pipe. See also Iron Trade Rev., vol. 79, no. 26, Dec. 23, 1926, pp. 1609-1613 and 1628, 8 figs.

PISTONS

Clearance. Piston Clearance, R. J. Anderson and M. A. Beckman. Automobile Engr., vol. 16, no. 223, Dec. 1926, pp. 486-490, 12 figs. With special reference to split-skirt type cast in aluminum.

PLANERS

Bevel-Gear. 19-Inch Spiral Bevel-Gear Planer. Machy. (Lond.), vol. 29, no. 738, Dec. 2, 1926, pp. 270-272, 4 figs. Recent development of Oerlikon Machine Tool Works, Switzerland, suitable for cutting all standard tooth pitches up to 2½ diametral pitch, being equivalent to 1.2 circular pitch or 10 module.

POWER

Progress, 1926. Progress in the Power Field. Power, vol. 65, no. 1, Jan. 4, 1927, pp. 2-8, 11 figs. All power output and capacity records have been broken; interconnection of power systems increasing rapidly and hydro-electric developments make good progress; rate of 12,600 B.t.u. per kw.-hr. maintained in steam plant for full month; higher pressures in ascendancy; progress in water-cooled surface and air preheaters; unit mills popular in pulverized-coal records.

PSYCHOLOGICAL TESTS

Metal Workers. Selective Placement of Metal Workers, M. Pond. Personnel Research—Jl., vol. 5, no. 9, Jan. 1927, pp. 345-368, 1 fig. Investigation of use of intelligence tests in selection of factory workers made in New England brass factory.

PULVERIZED COAL

Developments. Progress in the Burning of Pulverized Coal. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 9-16, 7 figs. Discussion of types of furnaces used, preparation and burning of coal, use of air preheaters and various operating experiences.

South Africa. Pulverized Fuel in South Africa. S. African Engr., vol. 16, no. 102, Oct. 1926, pp. 17-19. Equipment in new station at Congella; work of Electricity Supply Commission.

PUMPS

Corrosion. Some Cases of Corrosion in Chemical Works Pumps, H. Seymour. Indus. Chemist, vol. 11, no. 23, Dec. 1926, pp. 562-565, 4 figs. Corrosion in chemical-works pumps is due chiefly to action of acids, and when unsuitable materials have been used in construction of such pumps, parts made of non-resistant metal will enter into chemical combination with acid; great majority of corrosion phenomena is due to combined chemical and mechanical action on material.

Electrically-Driven. Electrically-Driven Pumps, F. Johnstone-Taylor. Elec.Times, vol. 70, no. 1834, Dec. 16, 1926, pp. 743-744, 3 figs. With special reference to automatic and remote control.

Industrial. Pumps for Industrial Purposes, I. Watson. Indus. Chemist, vol. 11, no. 23, Dec. 1926. pp. 553-556, 3 figs. Deals with pumps for chemical works, boiler pumps and pumps for general purposes.

PUMPS, CENTRIFUGAL

Boiler-Feed. Characteristics of Centrifugal Feed Pumps. Eng. & Boiler House Rev., vol. 40, no. 7, Jan. 1927. pp. 339-344, 2 figs. Discusses this type of pump, indicating trend of developments in British practice.

R

RADIOTELEGRAPHY

Development, 1926. Progress of the Wireless Section and of Wireless Generally During the Past Year, C. L. Fortescue. Instn. Elec. Engrs.—Jl., vol. 65, no. 360, Dec. 1926, pp. 39-47, 3 figs. Deals with transmitters, transmitting medium, reception, radio-frequency measurements and broadcasting.

Amplifiers. Notes on the Design of Resistance-Capacity Coupled Amplifiers, S. Harris. Inst. Radio Engrs.—Proc., vol. 14, no. 6, Dec. 1926, pp. 759-763, 4 figs. Analysis of coupling in resistance-capacity coupled amplifier, in which variation of voltage ratio with frequency is considered; method for determining values of resistances and capacities for which variation of voltage ratio over given frequency range will be definite and known amount.

Reception. Progress in Radio-Receiving During 1926, A. N. Goldsmith. Gen. Elec. Rev., vol. 30, no. 1, Jan. 1927, pp. 67-72, 17 figs. Most conspicuous alterations in radio condition have been advent of higher power broadcasting station and increased congestion in ether resulting from more or less haphazard selection of modified or new wave frequencies by previously existing or recently-established broadcasters; multi-stage tuning devices; catacomb construction; a.c. operation; loud-speaker construction.

RAILS

Corrugation. Study of Undulatory Wear of Rails (Contribution à l'étude de l'usure ondulatoire des rails), C. Fremont. Génie Civil, vol. 89, no. 20, Nov. 13, 1926, pp. 425-428, 13 figs.

Stresses. On the Measurement of Stress of Rails Caused by Train Running, H. Shibata. Dept. of Railways, Govt. of Japan—Bul., vol. 14, no. 11, Nov. 1926, pp. 1341-1355, 10 figs. Second report on dynamical studies of rails. (In Japanese.)

RAILWAY ELECTRIFICATION

United States. Main Line Railway Electrification, P. Dawson and S. P. Smith. Engineer, vol. 142, no. 3700, Dec. 10, 1926, pp. 626-628, 8 figs. Pennsylvania Railroad; Grand Trunk Railway; Michigan Central and Boston and Maine Railroad; Detroit, Toledo and Ironton Railroad.

RAILWAY OPERATION

Train Control. Rapid Progress in Automatic Train Control in 1926. Ry. Age, vol. 82, no. 1, Jan. 1, 1927, pp. 130-133, 2 figs. Active construction programme closes year with all but five installations under first order in service and 23 roads with second division complete.

RAILWAY SIGNALLING

Developments, 1926. 1926 Greatest Year in History for Signals and Interlocking. Ry. Signalling, vol. 20, no. 1, Jan. 1927, pp. 3-16, 2 figs. Records established for mileage and levers installed; new interest in spring switches and automatic signal interlockings; prospects for 1927.

RAILWAY TIES

Metal. Is the Wooden Railroad Tie Doomed? Scientific American, vol. 136, no. 1, Jan. 1927, p. 36, 1 fig. Ingeniously devised method of rolling steel containing small alloy of copper now makes possible tie that will last 50 years; one of largest transportation systems in world has adopted it as their standard; method of manufacture.

Stacking and Seasoning. Method of Stacking Ties Influences Rate of Seasoning, F. F. Franklin. Ry. Eng. & Maintenance, vol. 23, no. 1, Jan. 1927, pp. 11-12, 4 figs. Results of series of tests carried out on ties selected from stacks built according to two different methods; results tend to show that cribbed-up stack is better in securing quicker and more thorough seasoning, 15 to 20 per cent deeper penetration of preservative and more uniform penetration in ties from various parts of stack.

Switch. Specification for Switch-Ties. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 289, Sept. 1926, pp. 65-68. Material to be employed; physical requirements; design, manufacture, inspection, delivery and shipment.

RAILWAY TRACK

Concrete Base. Will the Track of the Future Be Supported on Concrete? Ry. Eng. & Maintenance, vol. 23, no. 1, Jan. 1927, pp. 5-8, 9 figs. Pere Marquette began practical test by operating trains over quarter-mile of special track construction in which rails are supported directly on concrete slab, in order to determine practicability of this form of construction. See also description in Ry. Age, vol. 82, no. 2, Jan. 8, 1927, pp. 174-177, 8 figs.

RAINFALL

Run-Off. The Effect of Bedrock on Run-Off of Wisconsin Streams, E. E. Foster. Eng. Soc. of Wis.—Bul., vol. 1, no. 3, July 1926, pp. 162-167 and (discussion) 167-174, 1 fig. Study made from data collected in period 1915 to 1923 showing average run-off 27.5 per cent greater from igneous rock regions than from sandstone and 9.4 per cent more from sandstone than from limestone.

REFRACTORIES

Porosity. On the Effect of Porosity Upon Thermal Conductivity, Diffusibility and Heat Capacity at High Temperatures, Y. Tadokoro. Tôhoku Imperial Univ. —Science Reports, vol. 15, no. 4, Oct. 1926, pp. 567-596, 17 figs. Results of experiments show that porosity varies similarly to gas permeability; both thermal expansion and crushing strength decrease as porosity of material increases; diatomaceous earth is one of best insulating materials occurring in nature. (In English.)

REGULATORS

Flywheel Balancer Sets. Regulator for Flywheel Balancer Sets, J. H. Ashbaugh. Elec. World, vol. 88, no. 26, Dec. 25, 1926, pp. 1315-1317, 4 figs. Handling of certain loads introduces peaks which can be smoothed out by using flywheel sets; regulator and protective devices developed to control operations.

RELAYS

Automatic Network. Operation Requirements of the Automatic Network Relay, W. R. Bullard. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 1, Jan. 1927, pp. 17-25, 7 figs. Relations between distribution-system and design characteristics of relays which are used to provide automatic control for so-called automatic, low-voltage, a.c. network distribution system.

Evolution of the Automatic Network Relay, J. S. Parsons. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 1, Jan. 1927, pp. 50-57, 11 figs. A.c. network unit has been developed to connect transformers to network, and "brains" of this unit, which is automatic network relay, which not only opens network breaker whenever there is trouble in any of high-tension equipment or when power feeds back into high-tension feeder, but also recloses breaker when conditions are restored to normal and feeder is in condition to supply power to network.

RESEARCH

Colleges and Industry. Research Relations Between Colleges and Industry, A. A. Potter. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 12, Dec. 1926, pp. 1272-1276. Points out that industry has clear-cut obligation to support engineering research at colleges in order to improve quality of college training, to advance basic knowledge in engineering and to increase supply of trained personnel.

RESERVOIRS

Algae Treatment. Algae Treatment of Reservoirs, Recent Experience, F. E. Hale. Am. Water Wks. Assn.—Jl., vol. 16, no. 6, Dec. 1926, pp. 765-768, 1 fig. Experience at Jerome Park, Central Park reservoirs and Croton watershed, New York.

Forest-Protection. Financial Limitation in the Employment of Forest Cover in Protecting Reservoirs, W. W. Ashe. U. S. Dept. Agriculture—Bul., no. 1430, Aug. 1926, pp. 1-16, 24 figs. Possibilities in storage of storm water for power; necessity of permanency of power reservoirs; influence of forest protection on silting; relative value of forest and other cover in reducing erosion of soil; settling basins; planting wood; regimen and turbidity of main stream systems in United States.

RIVETED JOINTS

Behaviour Under Load. An Investigation of the Behaviour and of the Ultimate Strength of Riveted Joints Under Load, E. L. Gayhart. Soc. Naval Architects & Mar. Engrs.—Advance Paper, no. 5, for mtg. Nov. 11-12, 1926, 14 pp., 12 figs. Study under tensile forces of slip phenomena and stress distribution in riveted joints; effect upon ultimate strength of joint of variations in rivet spacing, and effect of using rivets of grade softer than material of plates.

Tests. Tests of Large Riveted Joints of Various Steels. Eng. News-Rec., vol. 97, no. 22, Nov. 25, 1926, p. 864. Navy tests of 51 joints show best results with soft rivets; slip begins at shear of 6,500 lb. per sq. in.

RIVETS

Specification:. Tentative American Standards for Tinners', Coopers' and Belt Rivets, Small Rivets and Plow Bolts. Mech. Eng., vol. 48, no. 12, Dec. 1926, pp. 1480-1484, 12 figs.

RIVETING

WELDING vs. The Riveting and Welding Processes. Machy. (N.Y.), vol. 33, no. 5, Jan. 1927, pp. 350-351. Welding as applied to boilers; ductility and fatigue resistance; machine-driven rivets; future developments.

ROADS

SUB-GRADES. Simplified Soil Tests for Sub-Grades and Their Physical Significance. C. Terzaghi. Puc. Roads, vol. 7, no. 8, Oct. 1926, pp. 153-162 and 170, 15 figs. Physical meaning of simplified tests; physical significance of plastic limit; relation between plastic limit and critical bearing point; shrinkage limit; relations between limits of consistency; meaning of moisture equivalent; field moisture equivalent test erroneously named; dye-absorption test; interpretation of test results.

ROADS, CONCRETE

CONSTRUCTION. Efficiency in Concrete Road Construction. J. L. Harrison. Mun. & County Eng., vol. 71, no. 6, Dec. 1926, pp. 358-364. Discusses question of why output is often so low and what must be done to correct it. Address before Indiana Highway Constructors.

CONSTRUCTION, 1926. A Review of the 1926 Accomplishments in Concrete Pavement Construction, O. A. Steller. Concrete, vol. 30, no. 1, Jan. 1927, pp. 13-16, 6 figs. Construction activities during 1926 broke all previous records; yardage shows increase; wide highways occupy attention of planners; new construction methods; high early-strength concrete placed in pavements; shorter curing period used; plans for future.

DEVELOPMENTS. Recent Developments in Concrete Pavements, H. E. Breed. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 1, Jan. 1927, pp. 33-37. Review of developments; most important is progress in knowledge and education in regard to all types of highway construction.

SPACING CROSS JOINTS. Theory of Spacing Cross Joints in Concrete Roads, W. W. Zass. Eng. News-Rec., vol. 98, no. 1, Jan. 6, 1927, pp. 24-26. Moisture and temperature changes analyzed, internal and external restraint computed, slab stresses determined.

ROAD CONSTRUCTION

DEVELOPMENTS. Two Thousand Years of Road Building. Am. Highways, vol. 6, no. 1, Jan. 1927, pp. 6-10, 5 figs. Roman road building period; Napoleonic road building; present-day conditions; contrast between United States and European countries; financial aspects.

HOT-MIX PAVEMENTS. How to Ensure Effective Hot-Mix Pavements, F. P. Smith. Contract Rec., vol. 40, no. 47, Nov. 24, 1926, pp. 1120-1122. Construction details that are essential to best results; present-day traffic conditions demand higher standards; slighting of details leads to unsatisfactory service. Paper read before Asphalt Paving Conference, Washington, D.C.

MATERIALS AND MAINTENANCE. Materials for Road Construction, J. T. Donaghey. Can. Engr., vol. 51, no. 18, Nov. 2, 1926, pp. 601-605. Construction and maintenance of gravel roads in Wisconsin; construction policy for Western Canada; all-weather surface for main highways. Paper presented before Can. Good Roads Assn.

MIXING PLANT. Large Mixing Plant Tried Out on Road Work, R. T. Giles. Eng. News-Rec., vol. 97, no. 22, Nov. 25, 1926, pp. 866-867, 3 figs. Two miles of road a week was goal set for twin mixers mounted on traveller and served by industrial railway.

PROBLEMS. Conclusions Adopted by International Road Congress. Mun. and County Eng., vol. 71, no. 4, Oct. 1926, pp. 237-244. Summary of final conclusions adopted for concrete, bituminous and asphaltic roads, etc. See also Pub. Works, vol. 57, no. 10, Nov. 1926, pp. 367-368.

ROCK ASPHALT. Rock Asphalt Road Construction with New Devices, W. L. Moore. Eng. News-Rec., vol. 98, no. 1, Jan. 6, 1927, pp. 12-14, 6 figs. Short construction period called for quick tests and special construction devices; curb forms improved; corrugating and spray painting to bond asphalt to concrete.

SUB-DRAINAGE. Sub-Drainage in Road Construction, C. S. Parker and J. E. Randall. Can. Engr., vol. 51, no. 20, Nov. 16, 1926, pp. 637-640, 5 figs. Importance of tile drainage to keep sub-grade dry; experience of Township Commissioner in Illinois; system advocated by member of Federal Highway Council's Committee on sub-grade and its relation to road surfacing and traffic.

ROADS, GRAVEL

GRADING OF GRAVEL. Quality and Grading of Road Gravel, E. Skarin. Can. Engr., vol. 51, no. 21, Nov. 23, 1926, pp. 655-656, 2 figs. Simple and reliable method of telling if gravel will pack into hard and uniform surface. Paper presented before Can. Good Roads Assn.

ROADS, MACADAM

BITUMINOUS. Causes of Success and Failure of Bituminous Macadam Pavements, G. H. Henderson. Mun. & County Eng., vol. 71, no. 5, Nov. 1926, pp. 275-279. To insure successful bituminous macadam, begin at bottom and provide proper foundations and drainage and construct firm sub-base; constant care should be taken during whole construction process and faults corrected as they occur. Paper read before Asphalt Paving Conference.

FAILURE. Why Do Bituminous Macadam Roads Fail? G. H. Henderson Contract Rec., vol. 40, no. 47, Nov. 24, 1926, pp. 1117-1120. Points out if same care is used in details of construction as in case of cement concrete pavements, proportion of failures would be lessened.

ROLLING MILLS

BLOOMING MILLS. Continuous 42-in. Blooming Mill. Iron Age, vol. 118, no. 24, Dec. 9, 1926, pp. 1621-1625 and 1671, 8 figs. Ford plant, using 1,500-lb. ingots, expected to produce 100,000 tons per month; unique housings and manipulators.

ELECTRIC DRIVE. Electricity in Steel Manufacture. Elec. Engr. Australia & New Zealand, vol. 3, no. 7, Oct. 15, 1926, pp. 249-250, 1 fig. Details of electrical equipment of Victoria Iron Rolling Co. in Australia; scrap is melted and refined in 7-ton electric steel furnace of Heroult type, which has melted heats up to 10 tons; forgings up to 16½ tons weight are made on 500-ton Davy steam-hydraulic press; there are two rolling mills for manufacturing bar, rod and special sections; mill is driven by 1,000-h.p. Metropolitan Vickers 6,600-volt, three-phase induction motor.

HOT ROLLING. Recent Improvements in Hot Rolling Mills (Les récents perfectionnements apportés aux laminoirs à chaud), P. Brenier. Technique Moderne, vol. 18, nos. 19 and 21, Oct. 1 and Nov. 1, 1926, pp. 577-585, 37 figs.; and 650-653, 6 figs. Oct. 1: Discusses recent progress in blooming mills, two- and three-high mills; merchant, iron sheet-rolling and wire mills, etc.; their operation; auxiliaries. Nov. 1: Operation of mill trains and auxiliaries, elastic drive and reduction gear, cooling beds, etc.

ROOFS

SUSPENSION. Applying Principles of the Catenary to Roof Design, M. Elizondo. Eng. News-Rec., vol. 97, no. 27, Dec. 30, 1926, pp. 1071-1072, 2 figs. Designs for suspension roofs result from study of small-scale models; one type constructed on 10 x 12 building.

S

SAWS

HACKSAW BLADES. Methods in Making Hacksaw Blades. Am. Mach., vol. 65, no. 25, Dec. 16, 1926, pp. 975-978, 8 figs. Steel cut lengthwise of grain; teeth milled with gang mill; two methods of setting teeth; hardening "all hard" and "flexible-back" saw blades.

SCREW MACHINES

TANGENTIAL CHASER. A New Line of Screwing Machines. Brit. Machine Tool Eng., vol. 4, no. 42, Dec. 1926, pp. 516-519, 4 figs. Incorporation of tangential chaser in new line of bolt- and tube-screwing machines, Kendall & Gent, Ltd.

SCREW THREADS

MILLING MACHINES. Thread Miller Is Adapted for Production of Differential Carriers, W. L. Carver. Automotive Industries, vol. 55, no. 24, Dec. 9, 1926, pp. 972-973, 4 figs. Hall planetary machine offers interesting possibilities in accurate boring and shouldering operations.

SEWAGE

BIO-CHEMICAL OXYGEN DEMAND. Bio-Chemical Oxygen Demand of Raw and Treated Sewage, C. E. Keefer and R. T. Regester. Eng. News-Rec., vol. 97, no. 22, Nov. 25, 1926, pp. 870-873, 8 figs. Studies of results from screens, tanks, sprinkling filters and humus tanks and comparisons of data at Baltimore with 10 other plants.

INADEQUATE. Investigating Inadequate Sewers, A. Wells. Am. City, vol. 35, nos. 4 and 5, Oct. and Nov. 1926, pp. 479-482 and 653-656, 6 figs. Methods employed in Hartford, Conn., in investigating sewer overflows and alleged damages; shows ways of presenting findings to boards and to public.

SEWAGE DISPOSAL

DEVELOPMENTS. Developments in Sewage Disposal, A. E. Berry. Contract Rec., vol. 40, no. 52, Dec. 29, 1926, pp. 157-161 and 143. Discusses trends that have become evident in recent years, with particular reference to activated-sludge system.

ACTIVATED SLUDGE. Observations on Biological and Physical Properties of Activated Sludge, F. W. Harris, T. Cockburn and T. Anderson. Contract Rec., vol. 40, nos. 45 and 46, Nov. 10 and 17, 1926, pp. 1071-1073 and 1097-1100, 2 figs. Protozoa in activated sludge; enzymic rather than bacterial action; first principles of process; ratio between sewage and sludge varies; reactivation of return sludge; estimating dissolved oxygen; influence of aeration on density.

Recent Developments in Activated Sludge Process of Sewage Treatment, W. C. Roberts. Mun. & County Eng., vol. 71, no. 4, Oct. 1926, pp. 205-209. Usual design for plants consists primarily of four units, some method for removing coarser materials in sewage, aeration tanks, clarifier and arrangement for sludge disposal; summary of advantages of activated sludge method. See also Pub. Works, vol. 57, no. 10, Nov. 1926, pp. 378-381.

AERATORS. Submerged Contact-Aerators for Sewage Treatment, K. Imhoff. Eng. News-Rec., vol. 97, no. 24, Dec. 9, 1926, pp. 948-949. May be combined with old or new settling tanks and require only 0.1 cu. ft. of air per U. S. gal.; results of installation of contact aerators in three 2-storey tank plants in Germany.

Submerged Contact Aerators for Sewage Treatment, K. Imhoff. Surveyor, vol. 70, no. 1817, Nov. 19, 1926, p. 445, 2 figs. Contact aerators are submerged aerated contact filters which work in water and cause no loss of head; in this they differ from trickling filters and contact beds of fill-and-draw type, both of which work in free air and need head of sewage corresponding to their full depth; these aerators, which may be placed in either old or new settling tanks, are economical, especially where complete treatment of sewage is unnecessary.

ENGLAND. Sewage Disposal Practice in England, F. Johnstone-Taylor. Can. Engr., vol. 51, no. 25, Dec. 21, 1926, pp. 719-722, 6 figs. Principal features of activated-sludge system and its development in Great Britain; operation of typical plant; Reading has plant with capacity of 3,000,000 gal. per day; bio-aeration system of mechanical agitation.

SLUDGE-HANDLING. Sludge Transport in Clarification Plants. Eng. Progress, vol. 7, no. 12, Dec. 1926, p. 322, 5 figs. Details of sludge-handling plant which has been operating for some time in plant in city of Stuttgart; it may also be employed for clearing away coal slime deposited in settling tanks.

SLUDGE UTILIZATION. Sludge Disposal on Farm Land, W. Clifford. Water Works, vol. 65, no. 11, Nov. 1926, pp. 545-546. Utilization of sewage sludge for agricultural purposes.

SHAFTS

POWER-TRANSMITTING. Installation of Power Transmitting Shafts, J. H. Rodgers. Machy. (N.Y.), vol. 33, no. 5, Jan. 1927, pp. 363-365, 3 figs. Lineshafts for group drives; reducing twisting moment; suitable location of motor drive; specific case of inefficient installation.

TORSIONAL VIBRATION. The Torsional Vibration of Shafts and Shaft Systems, R. Lochner. Instn. Elec. Engrs.—Jl., vol. 65, no. 360, Dec. 1926, pp. 76-80, 4 figs. General theory of torsional oscillation is reviewed, and method is then evolved by which investigation of any number of vibrating masses is considerably simplified.

SHEARS

TWO MOVABLE KNIVES. Shears with Two Movable Knives, J. Hahn. Iron Age, vol. 118, no. 27, Dec. 30, 1926, pp. 1811-1814, 19 figs. Steel-mill unit designed for cutting upward; clean cut ends among advantages; avoids depressing table.

SILK

ARTIFICIAL. Artificial Silk, T. Brough. Roy. Soc. of Arts—Jl., vol. 75, no. 3864, Dec. 10, 1926, pp. 97-115, 7 figs. Presents details of how silk is produced in order to show resemblance between silk and new fibre which is known as artificial silk; discusses four processes in use in production of artificial silk: Chardonnet, Cupra-ammonium, Cellulose Acetate and Viscose.

SILOS

REINFORCED-CONCRETE. Reinforced-Concrete Silos at Ougrée-Marihaye Steel Works. Engineer, vol. 142, nos. 3700 and 3701, Dec. 10 and 17, 1926, pp. 633-636 and 654-655, 16 figs., partly on supp. plate. Construction of silos for storing and handling raw material for its coke ovens and blast furnaces.

SILVER DEPOSITS

ONTARIO. Anima-Nipissing Lake Area, E. W. Todd. Ont. Dept. Mines—Annual Report, vol. 35, 1926, pp. 79-104, 6 figs. Deals with continuation of work started in 1924 with object of mapping rocks in proximity to producing silver areas at Cobalt and South Lorrain.

Gowganda Silver Area, A. G. Burrows. Ont. Dept. Mines—Annual Report, vol. 35, 1926, pp. 1-61, 31 figs. Silver area is situated in southwestern part of district of Timiskaming; superficial deposits; production; power resources; occurrence of silver ore; mines and prospects. See also supplementary report by E. W. Todd on Gowganda Vein Minerals, pp. 62-78, 11 figs.

SILVER ORE

CONCENTRATION. Solving a Problem in Silver-Lead Ore Concentration, E. W. Ellis. Eng. & Min. Jl., vol. 122, no. 21, Nov. 20, 1926, pp. 815-816, 2 figs. Analysis of screened products and microscopical study shows what minerals are present and suggests method of treatment.

SLOTTING MACHINES

RAPID. Slot-Drilling Machine. Machy. (Lond.), vol. 29, no. 738, Dec. 2, 1926, pp. 272-274, 4 figs. Blundstone rapid slotting-machine has been specially designed to enable through slots with round ends to be produced in valve stems and round or other section bars by oscillating end milling cutters operating simultaneously from opposite sides of piece being slotted.

STOKERS

IMPROVEMENTS. Stoker Improvements Meet High Ratings. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 17-20, 2 figs. Furnace desgins limit stoker capacity; water walls, radiant superheaters and preheated air are reducing furnace sizes.

STRUCTURES

SINUSOID AND PARABOLA. Sinusoid and Parabola in Structural Design, R. Fleming. Can. Engr., vol. 51, no. 25, Dec. 21, 1926, pp. 731-732, 5 figs. Discovery of sinusoid; its distinctive properties; application to study of beam deflections by harmonic analysis; sinusoid vs. parabola in column deflections; shear across column determined by sinusoid only 78.5 per cent of that found by parabola.

SUBSTATIONS

OUTDOOR. 110-Kv. Outdoor Transformer Station at Ft. William, Ontario, for Hydro. Elec. News, vol. 36, no. 2, Jan. 15, 1927, pp. 27-31 and 35, 8 figs. 15,000-kva. capacity; power comes from Nipigon generators; unique features in design.

SUPERHEATED STEAM

CONVERSION INTO SUPERPRESSURES. Direct Conversion of Low-Pressure Superheats into Superpressures. Engineer, vol. 142, no. 3703, Dec. 31, 1926, pp. 718-719. Describes Perkins process first patented in 1827.

VALVES FOR. A New Superheated Steam Valve for High Pressures. Eng. Progress, vol. 7, no. 12, Dec. 1926, p. 321, 2 figs. Manufactured by firm of Dingler A. G. in Zweibrücken; even very large valves of this type can be opened and closed by hand; pressure compensation inside of valve is achieved by means of two guide rods.

SUPERHEATERS

DEVELOPMENTS. Higher Superheats Demand Many Changes. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 38-39, 3 figs. Increased superheater and changed boiler practice make necessary application of new types and other changes to give desired result.

SURVEYING

AERIAL. Aerial Surveys Lend Confidence on Hastily-Organized Job, K. Riddle. Eng. News-Rec., vol. 97, no. 27, Dec. 30, 1926, pp. 1072-1073, 2 figs. Plot of 18,000 acres of undeveloped land surveyed in minimum time; conclusions drawn from aerial photographs.

T

TESTING MACHINES

ALTERNATING-STRESS. Electro-Magnetic Alternating-Stress Testing Machine. Engineering, vol. 122, no. 3178, Dec. 10, 1926, pp. 722-724, 3 figs. Machine for carrying out alternating tensile and compression tests at rate of 500 cycles per second, so that complete tests can be carried out in few hours; machine also enables fatigue limit to be determined approximately in few minutes; made by C. Schenck, Darmstadt.

TESTS AND TESTING

MATERIALS. Selecting Materials for Service, F. E. Schmitt. Am. Soc. Steel Treating, vol. 11, no. 1, Jan. 1927, pp. 42-53. Primary trouble is that testing engineer usually measures conventionalized properties, whose correlation with daily service demands is largely unknown; therefore, tests of suitability for desired service should be developed in place of or to supplement present conventionalized tests; in such development of suitability tests, users of materials have excellent opportunity to assist.

TIDAL POWER

UTILIZATION. Power from the Tides, E. L. Fleming. Engineer, vol. 142, no. 3701, Dec. 17, 1926, p. 661. Discussion of project for development of cheap electrical power from tides in estuary of River Exe.

TIME STUDY

ROLLING MILLS. *See Rolling Mills.*

STANDARDIZATION OF DATA. Standardizing Time Study Data, A. M. Lindsley. Indus. Mgmt. (N.Y.), vol. 73, no. 1, Jan. 1927, pp. 33-40, 16 figs. How time study can be used to cut costs in moderate size plant.

TOOL STEEL

FAILURES. Tool Steel Failures—Their Causes and Cures, F. B. Lounsberry. Am. Soc. Steel Treating, vol. 11, no. 1, Jan. 1927, pp. 101-114, 31 figs. Various factors which assist toolmaker in selection of steels and in attainment of greatest possible service from manufactured tools; statements are based on data obtained in investigation of from 400 to 500 complaints per year, extending over period of years; 55 per cent of complaints are due to faults at mill and of these about one-half are due to faulty inspection; author believes that closer control in melting operations will eliminate much of trouble; electric furnace is valuable aid in this respect; accurate temperature control is imperative.

TRANSFORMERS

CONNECTIONS. Principles of Transformer Connections, V. E. Johnson. Power Plant Eng., vol. 30, nos. 4, 8, 12, 16 and 18, Feb. 15, Apr. 15, June 15, Aug. 15 and Sept. 15, 1926, pp. 265-267, 483-486, 692-694, 902-905 and 1011-1014, 98 figs. Feb. 15: Methods of testing and operating of transformers in parallel on single- and multi-phase systems. Apr. 15: Methods of analyzing voltage relations in, and methods of paralleling, 3-phase banks. June 15: phase transformation with static and rotary transformers. Aug. 15: Autotransformers and balance coils; booster connections. Sept. 15: Special types of transformers, accessories and protective devices.

DEHYDRATING BREATHER FOR. A Dehydrating Breather for Power Transformers, L. H. Hill. Elec. Light & Power, vol. 5, no. 1, Jan. 1927, pp. 27-28, 3 figs. New accessory device which fills need for simple, reliable and effective type of dehydrating breather, free from certain defects which are inherent in previous forms.

LOADING. The Loading of Distribution Transformers. Nat. Elec. Light Assn.—Serial Report, no. 267-3, Sept. 1926, 7 pp., 19 figs. Results of tests made to determine operating characteristics of transformers under typical service conditions; in order to give better basis for determining permissible loading of distribution transformers.

TESTING. A Wattmeter Method of Determining Transformer Constants, J. W. L. Varey. Instn. Engrs. Australia—Quarterly Bul., vol. 3, no. 12, Oct. 31, 1926, pp. 335-338. Method devised to determine resistance component and reactance component of vector difference between no-load voltage and terminal voltage of transformer delivering load.

TUNGSTEN

THORIA, EFFECT OF. Tungsten and Thoria, Z. Jeffries and P. Tarsov. Am. Inst. Min. & Met. Engrs.—Trans., no. 1614-E, Jan. 1927, 17 pp., 15 figs. Presence of metallic thorium in thoriated tungsten; size and dispersion of thoria particles; effect of work and heat on tungsten and thoria; special distribution of thoria in drawn wire; particle growth of thoria and grain growth of tungsten; solubility of thoria in liquid tungsten.

TUNNELS

RAILWAY, ENLARGING. Boston & Maine Increases the Clearances in Hoosac Tunnel. Ry. Eng. & Maintenance, vol. 23, no. 1, Jan. 1927, pp. 20-23, 4 figs. Enlarges dimensions of 25,081-ft. bore in short time, without accident or traffic interruption.

W

WATER SUPPLY

DISTRIBUTION-FEEDER SURVEY. Distribution-Feeder Survey as a Basis for Improvement Studies, V. B. Siems and E. K. Wilson. Am. Water Wks. Assn.—Jl., vol. 16, no. 6, Dec. 1926, pp. 705-714. Results of investigation of flow conditions, including investigation of mains ranging in size from 16 to 60 in. in diameter for which approximately 150 gauging points were located.

ICE CONTROLS. Theory and Use of Thermit Heat Units in Relieving Ice Conditions, H. T. Barnes. New England Water Works Assn.—Jl., vol. 40, no. 3, Sept. 1926, pp. 312-321, 5 figs. Account of new methods of ice control developed by author during past two years as result of study; thermit is mixture of metallic aluminum and iron oxide; it is non-explosive and cannot be burned with any ordinary fire.

GREAT LAKES. Purification and Other Improvements of Great Lakes Water Supplies, G. H. Fenkell. West. Soc. Engrs.—Jl., vol. 31, no. 11, Nov. 1926, pp. 4 3-422 and (discussion) 422-439, 3 figs. Account of how Detroit water department acquired supply of pure clear water; compares conditions in Detroit and Chicago.

ONTARIO. Water Supply of Port Arthur, Ont., W. B. Redfern. Can. Engr., vol. 51, no. 26, Dec. 28, 1926, pp. 741-746, 1 fig. Report of proposed improvements to supply; engineer recommends extension of intake pipe 3,000 ft. under Thunder Bay and installation of automatic duplicate chlorinators.

SURFACE, CANADAA. St. Lawrence and Southern Hudson Bay Drainage. Dept. of Interior, Canada—Water Resources Paper, no. 49, 1926, 119 pp., 2 figs. Report covering hydrometric investigations in province of Ontario for years 1923-24 and 1924-25.

WATER TREATMENT

CHLORINATION. Chlorine Studies and Some Observations on Taste-Producing Substances in Water, and the Factors Involved in Treatment by the Super- and De-Chlorination Method, N. J. Howard and R. E. Thompson. New England Water Works Assn.—Jl., vol. 40, no. 3, Sept. 1926, pp. 276-296, 2 figs. Discusses tastes and odors in chlorinated water, resulting from presence of phenolic substances and those of unknown origin. Bibliography.

COAGULATION WITH SODIUM ALUMINATE. Coagulation with Sodium Aluminate, J. B. Barnitt and E. H. Haux. Can. Engr., vol. 51, no. 25, Dec. 21, 1926, pp. 725-726. Useful properties of sodium aluminate; eliminates some of difficulties incidental to use of filter alum, when used alone or in conjunction with it. Paper presented at Southeastern Water & Light Assn.

IODIDES, USE OF. The Present Status of the Use of Iodides in the Minneapolis Water Supply, A. F. Mellen. Am. Water Wks. Assn.—Jl., vol. 16, no. 6, Dec. 1926, pp. 715-729. Deals with problem of water which is deficient in iodides, thus causing simple or endemic goitre; method of controlling amount of iodides in foods or water; iodization of public water supplies assures adequate quantity of iodides under proper supervision at all times and eliminates any special problem of public health administration; it is reasonable in cost and has particular advantage in that it is immediately available. Bibliography.

WATER WORKS

RATE-MAKING. Principles of Rate-Making, W. M. Wherry. New England Water Wks. Assn.—Jl., vol. 40, no. 3, Sept. 1926, pp. 249-270 and (discussion) 270-275. Reviews questions raised and disposed of in water-works cases reported since Jan. 1, 1925, dealing with rate-making.

WELDING

ELECTRIC. *See Electric Welding, Arc.*

GASEOUS ATMOSPHERE. Welding in a Gaseous Atmosphere. Am. Welding Soc.—Jl., vol. 5, no. 12, Dec. 1926, pp. 43-49. Discussion at meeting of Society in Buffalo.

MACHINERY BASES. Designing a Welded Steel Machinery Base, R. E. Kinkead. Machy. (N.Y.), vol. 33, no. 5, Jan. 1927, pp. 377-379, 4 figs. Redesigning of cast-iron machinery bases in order to substitute welded steel.

OXY-ACETYLENE. *See Oxy-Acetylene Welding.*

STEEL FOUNDRY. The Selection of a Welding Process, L. E. Everett. Acetylene Jl., vol. 28, no. 6, Dec. 1926, pp. 277-279. Conditions leading to selections of welding process in steel foundry, whose production is confined largely to straight carbon-steel castings.

WIRE

COLD-WORKING. The Influence of Cold-Working on the Physical Properties of Wire, A. J. Michel. Wire, vol. 2, no. 1, Jan. 1927, pp. 10-13 and 28, 4 figs. Shows that aging has same influence upon physical properties after cold working has been completed, as cold working of wire will normally have by itself.

WOOD

MACHINE FOR BENDING. A Roof-Stick Bending Machine. Engineer, vol. 142, no. 3701, Dec. 17, 1926, p. 672, 1 fig. Machine devised for bending roof-sticks of railway coaches and similar operations, manufactured by J. A. Fay and Egan Co. in Amercia.

TROPICAL HARDWOODS. Tropical Hardwoods with Special Reference to Their Use in American Industries, G. P. Ahern. Mech. Eng., vol. 49, no. 1, Jan. 1927, pp. 42-45. Outline of problems and details of programme of work for A.S.M.E. special research committee on substitute species for domestic woods.

WOOD PRESERVATION

IMPREGNATION WITH PARAFFIN. Impregnating Wood with Paraffin, L. W. Eberlin and A. M. Burgess. Indus. & Eng. Chem., vol. 19, no. 1, Jan. 1927, pp. 87-88. Experiments undertaken to obtain impregnated wood that would withstand action of acid and alkaline solutions with minimum absorption of moisture, and consequent swelling; most suitable kind of wood, impregnant and method of impregnation were sought.

WOOL

CHLORINATION. The Chlorination of Wool, J. B. Speakman and A. C. Goodings. Textile Inst.—Jl., vol. 17, no. 12, Dec. 1926, pp. T607-T614, 2 figs. Investigation of cause of unshrinkability and amount of chlorine necessary to produce this condition.

DRAWING AND SPINNING. Modern Ideas in Worsted Drawing and Spinning, S. Kershaw. Textile World, vol. 71, no. 2, Jan. 8, 1927, pp. 23-24. Summary of conclusions drawn from recent investigations of French system as compared with Bradford; twist in roving and yarn; cause and prevention of neps, slubs, irregularity and double yarn; and possibilities of adopting certain methods employed in cotton manufacture.

Z

ZINC DEPOSITS

EASTERN CANADA. Notes on Zinc and Lead in Eastern Canada, H. A. Robinson. Can. Dept. of Mines, Mines Branch, no. 669, 1926, pp. 60-68. Review of present conditions and activities at better-known zinc mines and prospects in eastern Canada.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

ACCELEROMETERS

ROTATING MACHINERY. A Recording Accelerometer for Rotating Machinery, H. W. Bousman. Mich. Technic, vol. 40, no. 2, Jan. 1927, pp. 20-21 and 32, 2 figs. Discusses its applications to synchronous machines, automotive testing and deceleration tests of generators.

ACCIDENTS

INDUSTRIAL. Incidental Cost of Industrial Accidents Is Four Times the Direct Loss, H. W. Heinrich. Mfg. Industries, vol. 13, no. 1, Jan. 1927, pp. 49-52.

PSYCHOLOGICAL STUDY. A Psychological Study of Individual Differences in Accident Rates, E. Farmer and E. G. Chambers. Indus. Fatigue Research Board—Report, no. 38, 1926, 45 pp., 6 figs.

ADHESIVES

CHEMICAL COMPOUND. Adhesives and Adhesion; True Chemical Compounds as Adhesives, J. W. McBain and W. B. Lee. Royal Soc.—Proc., vol. 113, no. A765, Jan. 1, 1927, pp. 606-620, 2 figs. Results of experiments made with solids and liquids of very diverse type.

AIR COMPRESSORS

TESTING. The Testing of Air Compressors, J. N. Williamson. Iron & Coal Trades Rev., vol. 114, nos. 3072 and 3073, Jan. 14 and 21, 1927, pp. 46-47 and 102-103, 9 figs. Special reference to measurement of volume compressed; relative importance of volume compressor efficiencies; value of air-compressor indicator cards.

AIR CONDITIONING

DEHUMIDIFICATION. Dehumidification Methods, M. C. W. Tomlinson. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 2, Feb. 1927, pp. 87-94, 7 figs. Reviews various methods and phases of dehumidification and points out, specifically, interesting method which has been neglected but which offers considerable advantage, especially to those who must work at low dew points and relative humidities.

REFRIGERATION APPLIED TO. Refrigeration as Applied to Air Conditioning, A. Lewis. Heat. & Vent. Mag., vol. 24, no. 1, Jan. 1927, pp. 80-86, 9 figs. Australian practice as compared to usual American methods with hygrometric chart from American and Indian sources.

AIRPLANES

AIRFOILS. The Modern Theory of Aerofoils and Its Application to Aeroplane Design. Instn. Aeronautical Engrs.—Proc., no. 20, ,1926, pp. 38-62 and (discussion) 63-64, 7 figs. Methods of using vortex theory in its practical applications; application to practical purposes; application of reduced section characteristics.

PERFORMANCE TESTING. Performance Testing and Analysis, R. S. Capon. Royal Aeronautical Soc.—Jl., vol. 31, no. 194, Feb. 1927, pp. 102-126 and (discussion) 127-132, 13 figs. Modifications made in methods of measurement and reduction to standard atmosphere at Air Force testing station at Martlesham; outlines form of analysis at present in use by research section which came into being at that station 18 months ago; indicates air tests, very different from present standard system, which best meet requirements of that analysis.

SEAPLANES. *See Seaplanes.*

STRUTS. Strength of Bent Struts, J. E. Younger. Air Corps Information Cir., vol. 6, no. 580, Dec. 1, 1926, 5 pp., 2 figs. Develops formula for determining strength of long struct when it is initially bowed.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*

BRASS. *See Brass.*

COPPER. *See Copper Alloys.*

LIGHT. Light Alloys. Metallurgist (Supp. to Engineer), Jan. 28, 1927, pp. 1-2. Review to progress in aluminum and magnesium alloys; in regard to production of aluminum there has been only one striking forward step development of method of refining aluminum by fusion electrolysis; development of pre-solidification processes; properties of beryllium.

MAGNESIUM. *See Magnesium Alloys.*

ALUMINUM

ANODIC OXIDATION. The Protection of Aluminum from Corrosion. Metallurgist (Supp. to Engineer), Jan. 28, 1927, pp. 7-8. Discusses process of anodic oxidation of aluminum or its alloys; properties of anodically-produced film are said to be remarkable; anodic oxidation is readily applicable to pure aluminum and to those alloys which do not contain too much copper.

CASTINGS. Impregnating Aluminum Castings with Silicate of Soda. Metal Industry (Lond.), vol. 30, no. 4, Jan. 28, 1927, pp. 109-110, 1 fig. Successful method of treating aluminum castings for porosity if used on gasoline or oil lines by use of silicate of soda; apparatus is composed primarily of two steel cylindrical shaped bottles, one known as impregnating bottle, other as feeder bottle.

ALUMINUM AND ITS ALLOYS, H. W. Clarke. Metal Industry (Lond.), vol. 30, no. 1, Jan. 7, 1927, pp. 21-23. Intensive recent research in aluminum; cast alloys of aluminum; duralumin type of alloys; wrought aluminum alloys; duralumin in aircraft construction.

ALUMINUM ALLOYS

ALUMINUM ALLOYS. *See Aluminum Bronze.*

ALUMINUM COPPER. Light Aluminum Copper Alloys. Foundry Trades Jl., vol. 35, no. 544, Jan. 20, 1927, p. 54. Methods of making up 92:8 aluminum copper alloy in foundries for casting purposes; defects; proportion of aluminum alloys in demand for other castings, such as aluminum-magnesium, aluminum-zinc, aluminum-copper-tin or aluminum-copper-manganese, is small compared with that for castings of 92 per cent aluminum and 8 per cent copper alloy.

ALUMINUM-MANGANESE. Equilibrium Relations in Aluminum-Manganese Alloys of High Purity, E. H. Dix, Jr., and W. D. Keith. Am. Inst. Min. & Met. Engrs.—Trans., no. 1633-E, Feb. 1927, 19 pp., 12 figs.

ATMOSPHERIC EXPOSURE, EFFECT OF. The Corrosion Products and Mechanical Properties of Certain Light Aluminum Alloys as Affected by Atmospheric Exposure, E. Wilson. Phys. Soc.—Proc., vol. 39, no. 216, Dec. 15, 1926, pp. 15-25, 3 figs.

CASTING. Still Casting of Metals, P. H. G. Durville. Am. Inst. Min. & Met. Engrs.—Trans., no. 1651-E, Feb. 1927, 6 pp. Pure aluminum, or alloy containing small proportion of aluminum, can be melted without flux except for layer of charcoal, because film of aluminum oxide and metal forms at surface of melted aluminum; although very thin, this film is air-proof, and it prevents metal underneath from oxidizing; this oxidized film does not move easily on account of its toughness and high surface tension; "still casting" as exemplified in two methods, permits of production without great expense and trouble, of alloys containing aluminum.

PROPERTIES AND USES. Aluminum Alloys, D. Hyman. Foundry Trade Jl., vol. 35, no. 545, Jan. 27, 1927, pp. 74-77, 1 fig. Nature of aluminum; commercial impurities; effect of alloy in copper; aluminum-silicon alloys; commercial alloys; improving properties; corrosion; heat treatment; ageing; foundry application; gating contraction. In discussion, action of chills, American practice compared, and aluminum alloys at elevated temperatures are touched upon.

ALUMINUM BRONZE

CASTING. Some Facts About Aluminum Bronze, W. Baunard. Brass World, vol. 23, no. 1, Jan. 1927, pp. 3-5. Practical hints to aluminum foundries concerning best methods of obtaining satisfactory castings difficulties which face beginner, when attempting fine work.

AMMONIA

LIQUID, PRECOOLING. Precooling Liquid Ammonia, W. Jahnke. Power, vol. 65, no. 4, Jan. 25, 1927, pp. 122-123, 3 figs. Methods used to precool liquid ammonia before it reaches evaporator in single- and multi-stage plants, and saving to be anticipated.

SYNTHETIC. Removal of Carbon Dioxide from Gas Mixtures Intended for Ammonia Synthesis, H. J. Krase and H. C. Hetherington. Indus. & Eng. Chem., vol. 19, no. 2, Feb. 1927, pp. 208-211, 4 figs. Partial vapour pressures of solutions of ammonium carbonate are compared with vapour pressures of similar solutions containing ammonium salts of CO_2, such as sulphuric and nitric; it is shown that partial pressure of carbon dioxide is greatly increased in latter case; application of this fact to removal CO_2 from gas mixtures is considered and data taken from operation of experimental plant are presented.

AUTOMOTIVE FUELS

ANTI-KNOCK COMPOUND. Influence of an Anti-knock Compound in a Gas-Ion Oxidation, S. C. Lind and D. C. Bardwell. Ind. & Eng. Chem., vol. 19, no. 2, Feb. 1927, pp. 231-233. Actual comparison of rates with and without diethyl selenium, of slow oxidation of methane under ionizing influence of alpha-radiation does not indicate any retardation by anti-knock compound but rather some acceleration; interpretation of this and its possible bearing on anti-knock theory.

GASOLINE. *See Gasoline.*

POTENTIAL SOURCES. Motor Car and Motor Fuel Potential, G. Egloff. Mich. Technic, vol. 40, no. 2, Jan. 1927, pp. 7-10 and 27-28, 4 figs. Urge of present period is to produce high anti-knock motor fuels in quantities sufficient to operate high-compression motors which must come on market so that more mileage per gallon of motor fuel will be obtained; paraffin, unsaturated, naphthene and aromatic hydro-carbons; treating of motor fuel.

B

BEAMS

REINFORCED-CONCRETE. The Design of Beams Reinforced for Compression, A. C. Hughes and C. S. Gray. Surveyor, vol. 71, no. 1825, Jan. 14, 1927, pp. 27-28, 4 figs. Notes applying to all rectangular beams which have reinforcement top and bottom.

BEARINGS, BALL

Angular-Contact. Use of Angular-Contact Ball Bearings, T. C. Delaval-Crow. Machy. (N.Y.), vol. 33, no. 6, Feb. 1927, pp. 406-409, 9 figs. Combined radial and thrust bearings; angle of contact determines thrust capacity; action of thrust bearing; applications of angular-contact bearings to machine tools.

BLAST FURNACES

Tuyere Connection. Blast-Furnace Tuyere Connection. Iron & Coal Trades Rev., vol. 114, no. 3071, Jan. 7, 1927, p. 5, 3 figs. Describes connection developed by H. Crowe, essential feature of which is improved form of constructing goose neck, which has spherical joint at its upper end so arranged as to possess ample movement in every direction, and fitted with one set of tension gears whose force acts in one direction only, allowing for expansion of all parts.

BOILER FEEDWATER

Treatment. The Scientific Treatment of Boiler Feedwater, Introducing the Colloidal Aspect, W. B. Lewis and S. G. Irving. Ceramic Soc.—Trans., vol. 25, 1925-26, pp. 200-205 and (discussion) 205-208. Application of colloidal chemistry to feedwater problems; water-softening plants; oxygen and corrosion.

BOILER FURNACES

Gas and Pulverized Coal-Burning. Burning Gas and Powdered Coal, J. G. Coutant. Iron Age, vol. 119, no. 6, Feb. 10, 1927, pp. 419-420, 3 figs. Boiler-furnace design for blast-furnace gas and pulverized fuel, separately or in conjunction.

Heat-Loss Estimation. How Thermocouples May Be Used for Estimating Heat-Loss from Surfaces, C. A. Miketta. Power, vol. 65, no. 4, Jan. 25, 1927, pp. 127-128, 1 fig. Heat-loss through furnace wall can be estimated directly by measuring surface temperature and referring to chart; with information given, radiation need no longer be classified with "unaccounted for" losses.

Oil-Fired. Enlarged Oil Furnace Increases Efficiency, F. Krug. Power Plant Eng., vol. 31, no. 4, Feb. 15, 1927, pp. 242-244, 3 figs. Boiler furnace remodelled to increase capacity and decrease maintenance expense.

Overfire Air Injection. Overfire Supplementary Air Introduction, A. E. Grunert. Power Plant Eng., vol. 31, no. 4, Feb. 15, 1927, pp. 245-247, 3 figs.
Increasing the Oxygen Supply Over the Fire, A. E. Grunert. Power, vol. 65, no. 4, Jan. 25, 1927, pp. 130-131, 2 figs. Air drawn from main forced-blast duct and forced through series of nozzles at furnace front toward centre of grate eliminates smoke and gives better combustion by supplying oxygen where there is deficiency and by improving air and gas mixture.

Radiant-Heat Absorption. Developments in Furnace Design, E. G. Ritchie and J. Mayer. Elec. Times, vol. 71, no. 1839, Jan. 20, 1927, pp. 80-81, 2 figs. Relating to use of radiant-heat absorbing surface.

Steam Jets. Improvement in Combustion by the Use of Steam Jets, C. D. Zimmerman. Power, vol. 65, no. 5, Feb. 1, 1927, p. 159, 3 figs. Steam jets have been installed on group of nine boilers at Lake Shore station of Cleveland Elec. Illuminating Co. with marked improvement in combustion.

BOILER PLANTS

Lubrication in. Boiler Plant Equipment, A. F. Brewer. Elec. Light & Power, vol. 5, no. 2, Feb. 1927, pp. 32-34 and 98, 6 figs. Tube-cleaning devices and their lubrication; economizers; steam-cylinder lubrication.

BOILER TUBES

Blowouts. Why Boiler Tubes Blow Out, J. M. Brennan. Power, vol. 65, no. 7, Feb. 15, 1927, pp. 242-244, 3 figs. External causes: (1) impingement of furnace flame; (2) slow distillation of tube metal by impregnation with fuel oil; (3) corrosion of external side of tube by sulphuric acid, formed by combination of moisture and combustion products of sulphur in oil used. Internal causes: (1) scale-forming feedwater; (2) grease on tubes; (3) steam locking or reverse of water flow; (4) corrosive feedwater; (5) segregation of tube metal. Notations are based on author's observations made where such conditions existed.

BOILERS

Electric. Electric Boilers for Industrial Drying (L'emploi des chaudières électriques en sechage industriel), G. Manquat. Technique Moderne, vol. 19, no. 1, Jan. 1, 1927, pp. 25-26, 1 fig.

Vertical. A Study of the Stresses Which Occur in Vertical Cross Tube Boilers, A. Wrench. Boiler Maker, vol. 27, no. 1, Jan. 1927, pp. 21-22, 8 figs. Deals with expansion stresses and defects caused thereby.

BRASS

Cast, Transition Point. A Study of the 470 Deg. Cent. Transition Point in Cast 60:40 Brass, F. H. Clark. Am. Inst. Min. & Met. Engrs.—Trans., no. 1637-E, Feb. 1927, 18 pp., 51 figs.

BRIDGE DESIGN

Niagara Falls Projects. Bridge Projects at Niagara Falls. Can. Engr., vol. 52, no. 4, Jan. 25, 1927, pp. 167-168, 1 fig. Three schemes for spanning gorge below Falls; traffic congestion becoming serious problem and arch bridge will soon become inadequate; memorial bridge would be of steel and reinforced-concrete construction.

BRIDGES, HIGHWAY

Steel. Construction of Buffalo-Fort Erie Bridge. Can. Engr., vol. 52, no. 2, Jan. 11, 1927, pp. 119-121, 4 figs. New structure, to be known as "Peace Bridge," has nine concrete piers and consists of approaches, 5 steel arches and 1 Parker truss over canal; total length is 4,250 feet.

BRUSHES

Carbon. Application of Carbon Brushes to Electrical Machines, P. D. Manbeck. Elec. World, vol. 89, no. 5, Jan. 29, 1927, pp. 239-240, 4 figs. Carbon brushes are classified as to grade and wearing characteristics; their application to specific conditions of service and type of machine enumerated in detail.

C

CAST IRON

Alloying Unit. Alloying Unit for Grey Iron Plants, H. P. Parrock. Iron Age, vol. 119, no. 3, Jan. 20, 1927, pp. 203-205.

Automotive Industry. Cast Iron Relating Particularly to the Automotive Industry, E. J. Lowry. Am. Metal Market, vol. 34, no. 32, Feb. 15, 1927, pp. 13-15.

Nickel. Nickel and Nickel-Chromium Cast Iron as Now Used in America, T. H. Turner. Foundry Trade Jl., vol. 35, nos. 544 and 545, Jan. 20 and 27, 1927, pp. 59-61 and 71-73, 5 figs. Influence of Ni and of Ni-Cr additions to cast iron; machinable hardness; extent to which Ni-Cr alloy cast irons are now being used; automobile castings; Diesel engine iron. Jan. 27: Marine and locomotive cylinders, liners and other cast iron parts; cost of making nickel and nickel-chromium additions to cast iron; application to centrifugal casting; method of adding nickel and chromium.

Testing. Impact Testing of High Duty Cast Iron. Foundry Trade Jl., vol. 35, no. 546, Feb. 3, 1927, pp. 98-100. Review of paper by J. G. Pearce, and discussion, together with author's reply.

CEMENT, PORTLAND

Moisture Reduction. Reducing the Moisture Content of Portland Cement Slurry by Filtration, D. C. Coulson. Rock Products, vol. 29, no. 26, Dec. 25, 1926, pp. 166-169, 9 figs. Describes one of most notable developments in wet-process cement manufacture.

CENTRAL STATIONS

Columbia, Ohio. Columbia Sets Record of 12,495 B.t.u. per kw.-hr., C. W. DeForest. Power Plant Eng., vol. 31, no. 3, Feb. 1, 1927, pp. 181-185, 7 figs.
12,495 B.T.U. Per Net. Kilowatt-Hour, C. W. DeForest. Elec. World, vol. 89, no. 7, Feb. 12, 1927, pp. 341-345, 6 figs. Obtained during 12th month of operation at Columbia station, which employs powdered coal, 600-lb. steam pressure, tandem turbines, steam reheat and three-stage bleeding; effect of tuning-up periods.

Cost Recording in. Generating Station Costs, R. O. Kapp. Elec. Rev., vol. 100, no. 2566, Jan. 28, 1927, pp. 124-126, 4 figs. Logarithmically ruled paper has certain advantages over ordinary squared paper, but hyperbolic ruling is more generally useful in engineering work; suits costing problems particularly well.

Equipment Friction. Suggestions for Safe Erection of Power Plant Equipment, N. L. Rea. Power, vol. 65, no. 7, Feb. 15, 1927, pp. 238-241, 20 figs. Hemp rope, wire rope and chains are used for handling power plant equipment and upon their proper care and use depends not only safety of equipment, but also that of those doing erecting work; things to do and not to do in handling machinery.

CHIMNEYS

Heating Boilers. A Rational Method for Determining Sizes of Chimneys for Heating Boilers, R. V. Frost. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 2, Feb. 1927, pp. 99-104, 1 fig. Presents table on average stack temperatures for corresponding temperatures at boiler outlet; upon calculation and comparison with draught intensities that were obtained in tests it was found that average temperatures selected checked very closely with theoretical temperatures.

COAL

Carbonization. The Missing Link in Low-Temperature Carbonization, C. B. Wisner. Combustion, vol. 16, no. 1, Jan. 1927, pp. 42-44. Describes new principle of low-temperature carbonization; it is dual or two-stage process in which oxidizal thermal pre-treatment, known as thermodizing, brings new conditions under which solid fuel made in retort is of as great weight and density as by-product coke made from same coal; although it is directly opposed to present theory and practice, it is seemingly sustained by fact that rotary processes are generally looking to briquetting their residual char for domestic fuel.

Cleaning. Mechanical Cleaning Makes Rapid Strides in 1926, T. Fraser. Coal Age, vol. 31, no. 4, Jan. 1927, pp. 129-132, 3 figs. New applications of old principles advance cause of better preparation of coal in both anthracite and bituminous fields; wet processes gain favour.

COAL HANDLING

Developments. A Brief Review of Some Recent Developments in Coal and Coke Handling and Storage, H. Blyth. Gas. Engr., vol. 43, no. 609, Jan. 1927, pp. 5-7, 4 figs. Application of reinforced concrete for supporting telpher lines; new coaling plant at Balmarnock.

COAL MINES

Concrete Construction. Concrete Construction in Coal Mines, H. S. Wright. Professional Engr., vol. 12, no. 2, Feb. 1927, pp. 5-7, 5 figs. Use of concrete in entry linings; stoppings; miscellaneous underground uses and grouting; use above ground; concrete requirements.

Electrical Apparatus. Permissible Electrical Equipment for Gaseous Mines, C. H. Matthews. Min. Congress Jl., vol. 13, no. 2, Feb. 1927, pp. 141-142, 3 figs. Permissible electrical apparatus being gradually developed; first consideration is safety, which justifies added expense for permissible equipment; electrical apparatus in frame of loaders and more compact design obtained.

Nova Scotia. Dominion No. 1B Colliery, Glace Bay, N.S., S. C. Mifflen. Can. Min. Jl., vol. 48, nos. 1, 2 and 3, Jan. 7, 14 and 21, 1927, pp. 6-8, 28-31 and 48-50, 4 figs. Example of modern practice in mining coal fields of eastern Canada.

COKE

Quenching. Dry Quenching of By-Product Coke, S. G. Koon. Iron Age, vol. 119, no. 6, Feb. 10, 1927, pp. 425-426, 2 figs. Economic advantages include heat recovery, reduced equipment maintenance charges and more and better coke for sale.

COKE OVENS

Refractories for. The Trend of Design in Modern Coke Oven Construction and Its Bearing Upon Refractory Materials, A. E. Vickers and A. T. Green. Fuel, vol. 6, no. 1, Jan. 1927, pp. 4-14, 12 figs. Advantages of silica appear to lie in its constant physical properties, which may be used to determine type of structure required; silica material stands up better under load, it is more resistant to corrosion and enables ovens to be operated at quicker rates than does fireclay, thus increasing output; discusses conductivity, radiation phenomena, spalling, insulation, effect of loads and atmospheres upon refractory materials; bibliography.

COLUMNS

Reinforced-Concrete. The Reinforced-Concrete Column, P. J. Markmann. Am. Concrete Inst.—Advance Paper, Jan. 1927, 41 pp., 11 figs. Calculation of stresses; plastic flow of concrete; synopsis of stresses; distribution of stresses along column shafts.

Steel. Tests of Large Columns with H-Shaped Sections, L. B. Tuckerman and A. H. Stang. U.S. Bur. of Standards—Technologic Papers, no. 328, Oct. 20, 1926, 88 pp., 32 figs. Sixty-nine columns, having H-shaped sections, of five different types of construction, were tested as flat-end columns in 10,000,000-lb. testing machine of Bureau of Standards; differences in column strength observed in these columns were in largest measure due to differences in yield point of material of which they were constructed; tensile yield points of material furnish close measure of column strengths, although yield points determined in commercial mill tests bore no apparent relation to column strengths.

CONCRETE

Aggregates. The Coarse Aggregate in the Concrete as a Field for Needed Research, H. J. Gilkey. Am. Concrete Inst.—Advance Paper, Jan. 1927, 35 pp., 9 figs. Results of tests to show how problem of isolating and attacking but one variable at a time can best be approached; tests in common with others seem to indicate beyond reasonable doubt that coarse aggregate is closely linked to strength; concrete is not as strong as its mortar.
Aggregates. Am. Concrete Inst.—Advance Paper, Feb. 1927, 34 pp., 3 figs. Requirements of gravel as aggregate for concrete; hardness and strength of gravel; durability, cleanness and grading; recommended studies and specifications; tests on effect of quality of gravel particles on their concrete-making properties; tests on effect of shale in gravel on compressive strength of concrete; characteristics of crushed-stone coarse aggregate.

Cast vs. Drilled. Cast vs. Drilled Specimens of Concrete, G. W. Hutchinson. Concrete, vol. 30, no. 2, Feb. 1927, pp. 47-48, 1 fig. Experiments to determine relation between laboratory concrete and concrete drilled from finished structure.

Consistency. The Consistence of Cement Pastes, Mortars and Concrete. Bldg. Research—Tech. Paper, no. 5, 1926, 54 pp., 23 figs. Methods for measuring consistence of neat cement pastes and sand mortars; factors affecting consistence of cement and mortar pastes; determination of consistence of concrete; influence of water content on consistence, mortar voids, crushing strength, modulus of elasticity and permeability of concrete; influence of consistence on workability and time of placing concrete. Bibliography.

Proportioning. Materials for Concrete Proportioned by Weight, R. W. Crum and M. Morris. Professional Engr., vol. 12, no. 1, Jan. 1927, pp. 24-26, 7 figs. Since 1924, materials for concrete have been proportioned by weight upon all paving projects built under supervision of Iowa State Highway Commission on primary road system of state; primary object of weight method of proportioning is to maintain definite and constant relationships between constituents of successful batches of concrete.

Quality Control. Economic Advantages, Field Control of Quality of Concrete. Am. Concrete Inst.—Advance Paper, Feb. 1927, 12 pp., 1 fig. Designing for economy and quality; arbitrary vs. designed mixtures. Bibliography.

Research. Researches on Concrete Materials and on Plain and Reinforced Concrete. Am. Concrete Inst. Report, Jan. 1927, 34 pp. Report of principal researches carried out in United States and Canada during 1926 on concrete materials and on plain and reinforced concrete; list of suggested researches is also included.

CONCRETE CONSTRUCTION

Standard Building Unit. Standard Building Units. Am. Concrete Inst.—Advance Paper, Jan. 1927, 12 pp. Report of tests on concrete building tile; specifications for concrete manhole and catch basin block; proposed standard specifications for concrete building block and building tile; proposed specifications for concrete brick.

Water Gain in. Water Gain and Allied Phenomena in Concrete Work, H. J. Gilkey. Eng. News-Rec., vol. 98, no. 6, Feb. 10, 1927, pp. 242-244, 3 figs. Cause of water gain; laboratory evidence of weak concrete at top; methods of remedying water gain.

CONCRETE CONSTRUCTION, REINFORCED

Progress, 1926. Reinforced Concrete in 1926. Concrete & Constr. Eng., vol. 22, no. 1, Jan. 1927, pp. 59-115, 83 figs. Record of work in hand completed during 1926 by leading firms in industry, giving good idea of vast amount of buildings and constructional work being done in reinforced concrete; also of variety of purposes for which it is found to be most suitable and economical material.

CONCRETE, REINFORCED

Building Regulations. Proposed Building Regulations for the Use of Reinforced Concrete. Am. Concrete Inst.—Advance Paper, Feb. 1927, 36 pp. Regulations are drawn to cover use of reinforced concrete in any structure to be erected under provisions of building code of which they form part; definitions; materials and tests; concrete quality and proportions; mixing and placing concrete; forms and details of construction; flexural computations and moment coefficients; summary of working stresses; shear and diagonal tension; reinforced concrete columns.

COLD STORAGE

Insulation. The Fundamentals of Cold Storage Insulation, S. Kay. Cold Storage, vol. 29, no. 344, Nov. 18, 1926, pp. 465-466. Consideration of factors of efficiency.

CONNECTING RODS

Articulated. The Articulated Connecting Rod, E. J. Fearn. Roy. Aeronautical Soc.—Jl., vol. 31, no. 194, Feb. 1927, pp. 133-141, 5 figs.

Counter-Balanced. Possibilities of the Counter-Balanced Connecting Rod, K. D. Wood. Sibley Jl. Eng., vol. 41, no. 1, Jan. 1927, pp. 2-6 and 44, 7 figs. Points out facts that (1) every automobile engine made to-day is dynamically unbalanced; (2) inertia unbalance of 2-, 4- and 6-cylinder engines can be completely eliminated by counter-balancing connecting rods; (3) engines thus balanced are better balanced than conventional 8-cylinder engine; (4) design of counter-balanced connecting rods is practical and adds little to cost of engine; and (5) if counter-balanced connecting rod is used, single-cylinder engine can be as well balanced as conventional six by means of geared balance described.

CONVEYORS

Electric Drive. The Application of Electric Drive to Conveyors, R. F. Emerson. Gen. Elec. Rev., vol. 30, no. 2, Feb. 1927, pp. 93-101, 14 figs. Types of conveyors and work done; factors determining power requirements; selection of type of motor to suit conveyor characteristics; a.c. and d.c. motors and control.

Pneumatic. Pneumatic Conveying of Gritty Materials, E. J. Tournier. Rock Products, vol. 30, no. 2, Jan. 22, 1927, pp. 40-50, 12 figs.

COOLING TOWERS

River Water vs. River Water or Cooling Towers? J. N. Waite. Elec. Rev., vol. 100, no. 2564, Jan. 14, 1927, pp. 46-48, 1 fig. Theoretical gain of thermal efficiency due to use of river water at 50 deg. Fahr., as compared with water artificially cooled to 75 deg. Fahr., for condensing, is partly neutralized by difficulty of dealing efficiently with immense volume of steam at pressure of 1 in. of mercury (absolute); instead of 10 per cent, net gain in practice is about 4 or 5 per cent.

COPPER ALLOYS

Corson Alloys. Copper Hardened by New Method, M. G. Corson. Iron Age, vol. 119, no. 6, Feb. 10, 1927, pp. 421-424, 9 figs. Besides high copper-silicon alloys there has recently been discovered group of 4 series of ternary alloys, known as Corson alloys, each containing relatively small amounts of silicon in addition to much larger amounts of chromium, iron, cobalt or nickel; all 4 series form natural class of alloys, which are amenable to heat treatment in a way that makes them appear to be counterpart of duralumin.

CRANES

Electric, Operation. Rules for the Safe Operation of Electric Overhead Travelling Cranes. Iron & Steel Engr., vol. 4, no. 1, Jan. 1927, pp. 25-26. Rules for crane operators; rules for floormen.

Railway Wrecking. Railway Breakdown Crane Design, E. K. Wright. Mech. World, vol. 81, no. 2088, Jan. 7, 1927, pp. 6, 1 fig. Features of interest and points that require careful consideration.

Steam. The Power Plant of a Locomotive Steam Crane, E. G. Fiegehen. Engineering, vol. 123, no. 3183, Jan. 14, 1927, pp. 60-61. Power plant consists almost invariably of vertical cross-tube boiler nad two-cylinder non-condensing double-acting steam engine, fitted with Stephenson link-motion reversing gear and coupled at right angles.

Steel Mills. General Specifications for Electric Overhead Travelling Cranes—Heavy Duty Steel Mill Service. Iron & Steel Engr., vol. 4, no. 1, Jan. 1927, pp. 21-25. Specifications applying to heavy-duty steel mill cranes, and as far as practical to cranes for special service, such as stripping ingots, charging ingots into and drawing them out of soaking pits, ore handling, charging open-hearth furnaces, etc.

CUTTING METALS

Research. A Research in the Elements of Metal Cutting, O. W. Boston. Mech. Eng., vol. 49, no. 2, Feb. 1927, pp. 139-146, 22 figs. Confined to tool sharpness, tool form, chip dimensions and force involved.

Steel Pipe. Cutting Steel Pipe Under the Ice, L. F. Hagglund. Successful Constr. Methods, vol. 9, no. 2, Feb. 1927, pp. 32-33, 4 figs. Describes work of divers beneath surface of lake Erie using oxy-electric torch, which combines heat of electric arc, together with oxidizing effect of gaseous oxygen under high pressure; heat of arc is sufficient to melt metal even under water, and oxygen brought in contact with this molten metal rapidly destroys metallic structure and effects cut.

Under-Water. Cutting Metals Under Water, L. F. Hagglund. Acetylene Jl., vol. 28, no. 7, Jan. 1927, pp. 325-327 and 357, 7 figs.

CUTTING TOOLS

Aluminum Alloys. Turning Tool for Aluminum Alloys. Eng. Progress, vol. 8, no. 1, Jan. 1927, p. 6, 1 fig. New cutting tool which is really combination of two tools, namely: roughing and finishing tool; results of tests on alloy containing 78 per cent aluminum and 22 per cent silicon.

CYLINDERS

Finishing Bores of. Finishing Cylinder Bores. Automobile Engr., vol. 17, no. 224, Jan. 1927, pp. 24-28, 4 figs. Review of methods employed by British manufacturers.

D

DIESEL ENGINES

Airless-Injection. The F. Krupp Works Builds Solid-Injection Diesel. Power, vol. 65, no. 6, Feb. 8, 1927, pp. 209-210, 3 figs. Drift toward airless-injection engines is recognized by F. Krupp; type is standard for medium powers; experiments made on 1,000-h.p. cylinder.

Compressorless. A Low-Power Diesel Engine. Power Engr., vol. 22, no. 251, Feb. 1927, p. 47. "Cold-Diesel," name intended to express "compressorless Diesel," solid-injection Diesel engine designed by German engineers; design follows in main submarine engine used during World War.

Fuel and Lubricating Oil, Inter-relation. Inter-relation Between Fuel and Lubricating Oil. Oil Engine Power, vol. 5, no. 2, Feb. 1927, pp. 88-89. Effect of combustion on lubrication, particularly with heavy fuel.

Hamilton-M.A.N. The Hamilton-M.A.N. Marine Diesel Engine. Mar. Eng. & Shipg. Age, vol. 32, no. 2, Feb. 1927, pp. 84-87, 7 figs. Four-cylinder, double-acting, two-cycle engine of 3,300 h.p. built for Shipping Board.

Small. Smaller Diesel Engines Developed, R. H. Bacon. Mar. Rev., vol. 57, no. 2, Feb. 1927, pp. 26-27 and 46, 4 figs. Fairbanks-Morse has announced line of Diesel engines in 10-h.p. cylinder size operating at speed of 650 r.p.m., suitable for direct drive for use in small craft and also in Diesel generating sets for use as auxiliaries in connection with main propulsion engine.

DRILLING MACHINES

Cam Milling on. Automatic Cam Milling on Drilling Machine. Machy. (Lond.), vol. 29, no. 743, Jan. 6. 1927, pp. 447-448, 3 figs. Simple automatic method of milling cam tracks on two-spindle vertical drilling machine.

Connecting-Rod. Double-Spindle Connecting-Rod Drilling Machine. Engineer, vol. 143, no. 3707, Jan. 28, 1927, pp. 106-107, 4 figs. Constructed by G. Swift & Sons, Halifax, to order of Bombay, Baroda and Central India Railway, for simultaneously drilling holes in ends of locomotives connecting and coupling rods.

DRYDOCKS

St. John's, Newfoundland. Cost of New Dry Dock at St. John's, Wm. I. Bishop. Can. Engr., vol. 52, no. 5, Feb. 1, 1927, pp. 175-176, 2 figs. Original estimate did not include number of items that were subsequently added by Government; lowest cost per ton capacity of any dock in North America; reply to article by A. Vatcher in November 16th, 1926, issue.

DURALUMIN

Protective Coatings. Protective Coatings for Duralumin and Similar Light Weight Alloys for Exposed Construction, H. A. Gardner. Am. Paint & Varnish Mfrs'. Assn.—Circular, no. 296, Jan. 1927, 26 pp., 9 figs. Results of series of tests.

Welding. Duralumin Welding, W. Nelson. Aviation, vol. 22, on. 3, Jan. 17, 1927, pp. 130-132, 3 figs. Possibilities and methods of gas welding; fluxes used; welding sheet metal.

E

ELECTRIC FURNACES

Induction. Induction Furnace Finds Wider Use, E. C. Kreutzberg. Iron Trade Rev., vol. 80, no. 2, Jan. 13, 1927, pp. 139-141, 6 figs. Describes furnace in use at new plant of Ajax Co. for melting nickel steel; melting equipment is tilting frame which holds crucible in induction coil, latter forming nest for crucible. See also description in Metal Industry (N.Y.), vol. 25, no. 1, Jan. 1927, pp. 4-5, 7 figs.

Melting. Electric Furnaces for Melting Metal. Blast Furnace & Steel Plant, vol. 15, no. 1, Jan. 1927, pp. 34-36, 1 fig. Practice in melting both iron and steel; methods of control and various furnace types.

Tempering. Electric Furnace for Tempering Tools. Ry. Elec. Engr., vol. 18, no. 2, Feb. 1927, p. 64, 1 fig. New box or hearth-type electric furnace, particularly applicable to tempering of lathe and planer tools, dies and punches in tool rooms, is manufactured by Westinghouse Co., East Pittsburgh, Pa.

ELECTRIC GENERATORS, A.C.

High-Frequency. Types of High-Frequency Alternators, J. F. Calvert. Elec. Jl., vol. 24, no. 1, Jan. 1927, pp. 36-39, 11 figs. External and internal cascade generators; inductance or variable-reluctance generators.

ELECTRIC MEASURING INSTRUMENTS

Standards. Electric Measuring Instruments. Am. Inst. Elec. Engrs.—A.I.E.E. Standards, no. 33, Jan. 1927, 10 pp. Standards apply to ammeters, voltmeters, wattmeters, reactive volt-ampere meters, frequency meters, power-factor, reactive-factor and phase-angle meters and synchroscopes; definitions, rating, heating and characteristics, dielectric test; insulation resistance.

ELECTRIC MOTORS

Locating Faults. Locating the Fault Before It Causes Trouble, J. E. Housley. Power, vol. 65, no. 4, Jan. 25, 1927, pp. 133-134, 3 figs. Tests indicating method of adapting motor tests on any heavy equipment to indicate its condition and make necessary changes or repairs.

Mill-Type. Atl. & S. E. E. Standardized Commutating Pole Mill-Type Motor Final Report of Standardization Committee, A. C. Cummins. Iron & Steel Engr., vol. 4, no. 1, Jan. 1927, pp. 88-91, 6 figs. Final dimensions agreed upon by manufacturers and committee as those most desirable for Association's standardized mill-type motor.

ELECTRIC MOTORS, A.C.

Accessories. Some Accessories Often Used With Large Induction Motors, D. F. Alexander. Elec. Jl., vol. 24, no. 1, Jan. 1927, pp. 14-20, 14 figs. Deals with space heaters, speed-indicating magnetos, overspeed devices, thermocouple and resistance-coil temperature indicators and relays, differential relays, dust-proof and drip-proof parts and forced ventilation.

Rolling Mills. General Specifications of A.C. Motors for Main Roll Drive. Iron & Steel Engr., vol. 4, no. 1, Jan. 1927, pp. 29-34. Results of two years' discussion on subject of Standardization of Rating of Large Rolling Mill Motors; they represent consensus of opinion of not only large majority of users, but also of designers of such motors.

Starting. The Starting of Single-Phase Induction Motors, F. A. Lauper. Instn Elec. Engrs.—Jl., vol. 65, no. 361, Jan. 1927, pp. 160-182, 35 figs. Deals only with electric starting devices which have found an extensive commercial application for motors from about 1 to 100 h.p.

Synchronous. How Synchronous Motors Are Started, R. M. Matson. Power, vol. 65, no. 6, Feb. 8, 1927, pp. 214-217, 7 figs. Types of starting equipment, methods of automatically-connecting field coils to source of excitation; protection that should be provided for motor.

ELECTRIC MOTORS, D.C.

Control. Control for Direct-Current Industrial Motors, R. T. Kintzing. Elec. Jl., vol. 24, no. 1, Jan. 1927, pp. 23-25. Face-plate, drum and magnetic or automatic controllers, protective devices on controllers.

ELECTRIC RESISTANCE

Contact. Contact Resistance, B. W. Jones. Gen. Elec. Rev., vol. 30, no. 2, Jan. 1927, pp. 85-86. Physical explanation of contact resistance; chemical reactions; influence of surface shape; study of circuit-opening contacts.

ELECTRIC TRANSMISSION LINES

Ground Detectors. Ground Detectors Warn of Dangerous Conditions, L. F. Hunt. Jl. Electricity, vol. 56, nos. 7 and 8, Apr. 1 and 15, 1926, pp. 262-263 and 298-299, 9 figs. Design features and operating characteristics of various types of instruments outlined and compared.

Power Losses. Computing Power Losses in Transmission Lines, Fred. C. DeWeese. Power Plant Eng., vol. 31, no. 4, Feb. 15, 1927, pp. 253-254. Method of calculating mean annual current with high degree of precision.

Quebec-Isle Maligne. Electrical Characteristics of the Quebec-Isle Maligne Transmission Line, C. V. Christie. Eng. Jl., vol. 10, no. 1, Jan. 1927, pp. 13-16, 5 figs. Location, construction and electrical features of transmission line at present under construction between Isle Maligne and Quebec City.

Service Reliability and. Transmission and Service Reliability. Elec. World, vol. 89, no. 6, Feb. 5, 1927, pp. 299-301, 6 figs. Latter not direct function of transmission reliability if more than one feed and proper relaying are provided; analysis of performance of 5 sections of transmission line.

ELECTRIC WELDING, ARC

Arc Sputtering. Theory of Arc Sputtering, J. B. Green. Welding Engr., vol. 12, no. 1, Jan. 1927, pp. 29-31, 1 fig. Silent and hissing arcs; chemical changes in deposit metal; and in arc atmosphere; arcs in inert cases; protective electrode coating; development of theory of sputtering and its applications.

Building Construction. Designing the Sharon Building for Arc-Welding, G. D. Fish. Eng. News-Rec., vol. 98, no. 3, Jan. 20, 1927, pp. 102-106, 6 figs. Successful construction of 5-storey factory building of Westinghouse Elec. & Mfg. Co. required many departures from usual practice; continuity of beams utilized to secure economy.

Structural Steel. Arc-Welded 5-Storey Building Nears Completion. Iron Trades Rev., vol. 80, no. 2, Jan. 13, 1927, pp. 136-138, 6 figs. Welding of 5-storey structure at Sharon, Pa.

ELECTRIC WELDING, RESISTANCE

Testing Welds. Testing Resistance Welds, J. W. Meadowcroft. Welding Engr., vol. 12, no. 1, Jan. 1927, pp. 41-42, 3 figs. Points out that microscope will reveal quality of joints in butt, flash and spot welding.

ELECTRICITY, APPLICATIONS OF

Agriculture. Farm Electrification—What of Its Future? E. A. White. Elec. World, vol. 89, no. 7, Feb. 12, 1927, pp. 345-346. Cultivated installations will stimulate; large usage developed on some farms; special utility personnel significant; financing and rates stabilizing.

ELECTROCHEMISTRY

Progress. Recent Advances in Electrochemistry, C. G. Fink. Min. & Met., vol. 8, no. 242, Feb. 1927, pp. 52-55, 4 figs. Increasing demand for electric furnaces calls for better refractories; methods for making purer metals; insoluble anodes and new methods of overcoming corrosion.

ELECTROLYSIS

Alternating-Current. Alernating-Curent Electrolysis, J. W. Shipley and C. F. Goodeve. Eng. Jl., vol. 10, no. 1, Jan. 1927, pp. 3-8, 7 figs. Results of further experiments on generation of explosive gases in electrical heating equipment of water-resistor type.

Effects of. Methods for the Determination of Electrolysis Effects, B. A. Williamson. Elec. West (formerly Jl. Electricity), vol. 58, no. 1, Jan. 1927, pp. 22-24, 2 figs. Procedures are suggested for measurement of potential between cable sheath and earth and for direct measurement of sheath-current leakage.

EVAPORATORS

Heat Transfer in. Improving Heat Transfer in Refrigeration Evaporating Apparatus, T. Shipley. Power, vol. 65, no. 5, Feb. 1, 1927, pp. 167-169, 4 figs. Two years' investigation made by Research Dept. of York Mfg. Co. to determine heat transmission through surface of evaporating apparatus under varied operating conditions, resulted in new designs of coils from which rates of heat transfer up to 180 B.t.u. were obtained, as compared to 15 B.t.u. in average plant.

F

FACTORIES

Heating. Effective Factory Heating, K. D. Hamilton. Factory, vol. 37, no. 5, Nov. 1926, pp. 802-805, 910, 912 and 914; and vol. 38, no. 2, Feb. 1927, pp. 280-283, 360, 362 and 364, 8 figs. Nov.: Selecting and installing equipment. Feb.: Planning and operating heating system.

FANS

Pressures and Efficiencies. Fan Pressures and Efficiencies, J. H. Roberts. Colliery Eng., vol. 4, no. 35, Jan. 1927, pp. 32-37, 16 figs. Attempts to set out in logical order various pressures with comments on their derivation and uses; results of tests.

Positive and Non-Positive. Air Movers: Positive and Non-Positive, F. G. Whipp. Mech. World, vol. 81, no. 2090, Jan. 21, 1927, pp. 43, 3 figs. Notes designed to remove haziness as to limits to which fan can be employed for movement of air and maintenance of pressure.

FEEDWATER HEATERS

Design. Feedwater Heaters, W. Smith. Mech. World, vol. 81, no. 2088, Jan. 7, 1927, pp. 3-4, 3 figs. Discusses different types of heaters, including surface or closed type, direct-contact or open type.

FEEDWATER HEATING

Bleeding Steam. Tests for Resultant Economy. Elec. Rev., vol. 100, no. 2567, Feb. 4, 1927, pp. 167-168. Calculation of ultimate gain resulting from heating of boiler feedwater by means of steam " bled " from main turbines.

FLOW OF LIQUIDS

Jets. Flow in Jets (Sur l'écoulement par jet), R. Mazet. Académie des Sciences—Comptes Rendus, vol. 183, no. 18, Nov. 3, 1926, pp. 735-736.

Orifices. Flow Through Circular Orifices (Sur l'écoulement à travers un orifice circulaire), R. Mazet. Académie des Sciences—Comptes Rendus, no. 2, Jan. 10, 1927, pp. 73-75. Calculations supplementary to author's two previous articles in 1926 volume of same journal.

FLUIDS

Viscosity. Laws of Viscosity of Fluids (Lois de la viscosité des fluides), J. Dubief. Jl. de Physique, vol. 7, no. 12, Dec. 1926, pp. 402-413, 8 figs. Authors point out that up to present no law exists explaining viscosity in function of density or pressure; kinetic theory permits establishment of simple relation, which applies to compressed gases as well as to liquids.

FORESTRY

Canada. Woodlands Management and Operation, S. L. de Carteret. Eng. Jl., vol. 10, no. 2, Feb. 1927, pp. 79-86. Conditions governing forest development with exploitation.

Quebec. Notes on the Forests of Quebec, G. C. Piché. Eng. Jl., vol. 10, no. 2, Feb. 1927, pp. 75-78. Problems of forest administration; extent of resources; ownership of forests; timber license requirements; forest inventories; reduction of logging waste; present state of industry.

FORGING

British and American Practice. British and American Practice in the Working of Hot and Cold Metals, F. W. Spencer. Metal Industry (Lond.), vol. 30, no. 5, Feb. 4, 1927, pp. 139-140. Drop hammer; steam and board hammers; non-ferrous forgings; steel forgings; forging cold.

FORGINGS

Brass. Brass Forgings, O. J. Berger. Mech. World, vol. 81, no. 2090, Jan. 21, 1927, pp. 50-51. Gives reasons for replacing brass castings with forgings; comparison of machining costs; finish and strength of forgings; equipment for forging shop; preparing blank; dies for hot-pressed parts, and for drop-steam hammers; importance of correct heating.

G

GAS ENGINES

Efficiency. Study of Efficiency of Gas Engines (Etude sur le rendement des moteurs à gaz. Irrégularité de la pression d'alimentation), M. Laffargue. Revue de Métallurgie, no. 12, Dec. 1926, pp. 739-743, 2 figs. Results of tests on engine using blast-furnace gas, connected to alternator in power plant of large steel works, in order to determine necessity of regulating gas pressure, and to what extent; M.A.N. 2-cylinder engine was used in tests.

GAS MAINS

Leakage Testing. Practical Leakage Testing, C. E. Williams. Min. & Met., vol. 8, no. 242, Feb. 1927, pp. 78-81, 2 figs. Theory of leakage testing by pressure-drop method; details of procedure in field; forms for record keeping and methods of calculation.

GAS TURBINES

Exhaust-Gas. An Exhaust-Gas Turbine. Gas & Oil Power, vol. 22, no. 257, Feb. 3, 1927, p. 99, 1 fig. Details of Lorenzen exhaust-gas turbine supercharger; in this design turbine rotor is utilized simultaneously also as impeller for compressing air, latter flowing through passages in turbine blades in radial direction.

GASOLINE

Tests. Comparison of Gasolines by Analytical and Engine Tests, D. R. Stevens and S. P. Marley. Indus. & Eng. Chem., vol. 19, no. 2, Feb. 1927, pp. 228-231, 1 fig.

Volatility. Modern Motor Fuels, W. A. Whatmough. Automobile Engr., vol. 17, no. 224, Jan. 1927, pp. 15-18, 7 figs. Comparison of volatility of gasolines of 1926 with one another and with motor fuels of four years ago.

GEAR CUTTING

Cutter Sharpener. Gleason 12-Inch Automatic Wet Cutter Sharpener for Spiral Bevel Gears. Am. Mach., vol. 66, no. 5, Feb. 3, 1927, pp. 233-234, 1 fig.

GEARS

Grinding. Grinding Worms and Gears, H. R. Simonds. Abrasive Industry, vol. 8, no. 2, Feb. 1927, pp. 61-62, 3 figs. Irregularities due to warping in heat treatment are overcome by employing special machine which generates accurate lead.

Hardening. Hardening Gears with the Oxy-acetylene Torch. Acetylene Jl., vol. 28, no. 8, Feb. 1927, pp. 386-388, 1 fig. New method used in England, known as Shorter process, whereby maximum hardness can be imparted to wearing faces of gear-wheel teeth with minimum of distortion; it is claimed that with this process gears can be hardened without distortion.

Worm. Worm Reduction Units for Power Transmission, G. H. Acker. Indus. Engr., vol. 85, no. 1, Jan. 1927, pp. 6-8 and 11, 7 figs. Superiority of present- over old-style worm gear is due to improvements in tooth and thread design, in addition to use of proper materials and workmanship; feature of modern worm-gear reduction unit is its ability to maintain its high efficiency throughout life; uses of worm-gear drives on great variety of machinery.

GOVERNORS

Uses and Characteristics. Governors for Boiler-Feed Pumps, Engine-Driven Fans and Centrifugal Pumps. South. Power Jl., vol. 45, no. 1, Jan. 1927, pp. 14-23, 29 figs. Various uses to which governors are put and characteristics of different designs.

GRINDING

Machine-Shop Practice. Grinding—And Its Service to the World. Can. Ry. Club, vol. 25, no. 10, Jan. 1927, pp. 21-32 and (discussion) 32-43. Discusses problems in field of grinding relating to machine-shop practice.

GRINDING MACHINES

CENTRELESS. Centreless Grinding Machines, J. Horner. Engineering, vol. 123, nos. 3183 and 3185, Jan. 14 and 28, 1927, pp. 36-37 and 93-94, 11 figs. Detroit grinding machines were first centreless grinders to be built, and differ from all subsequent designs in arrangement of wheels, which are disposed in vertical relation; Heim and Coventry machines.

SHARPENING GEAR CUTTERS. Mounting and Sharpening Double-Helical Gear-Planer Cutters. Machy. (Lond.), vol. 29, no. 746, Jan. 27, 1927, pp. 556-558, 10 figs. J. Parkinson & Son, Shipley, have introduced vertical-spindle grinding machine, especially for sharpening cutters used in Sunderland double-helical gear-generating machines; it is a box-section pillar-type machine with large square base.

SPINDLE-POINT. Spindle-Point Grinding Machine. Machy. (Lond.), vol. 29, no. 744, Jan. 13, 1927, p. 486, 2 figs. New type developed by H. Hunt & Sons, Manchester, for finishing and re-pointing ends of textile-machine spindles.

HEAT TREATMENT

DEVELOPMENTS. Recent Developments in Heat Treating Equipment (Les progrès récents réalisés dans l'equipment des ateliers de traitement thermique), J. Galibourg and J. Cournot. Technique Moderne, vol. 18, no. 23, Dec. 1, 1926, pp. 737-750, 34 figs.

H

HIGHWAYS

LOCATION. Economic and Engineering Problems of Highway Location, W. W. Crosby. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 2, Feb. 1927, pp. 210-225. Analysis of economic problems.

RESEARCH. Reports on Highway Research. Pub. Works, vol. 58, no. 1, Jan. 1927, pp. 27-31, 2 figs. Summaries of reports presented at Sixth Annual Meeting of Highway Research Board on economic theories and structural design of roads, character and use of road materials, highway finance, traffic analysis and road maintenance.

HOISTS

ELECTRIC. Control and Braking of Electric Hoists (Commande et freinage des appareils électriques de levage), M. Bizot. Electricien, vol. 43, no. 1413, pp. 49-55, 10 figs. Deals with automatic and hand brakes; electric rheostats and potentiometric brakes; induction motors.

HUMIDITY

RECORDERS. Some Recent Temperature and Humidity Recorders. Mech. World, vol. 81, no. 2090, Jan. 21, 1927, p. 47, 2 figs. Describes two instruments made by Negretti & Zambra, London, for recording changes in temperature and humidity.

HYDRO-ELECTRIC DEVELOPMENTS

BRITISH COLUMBIA. The Water Power Developments of the Alouette-Stave-Ruskin Group of the British Columbia Electric Railway Company, Limited, E. E. Carpenter. Eng. Jl., vol. 10, no. 1, Jan. 1927, pp. 17-39, 16 figs. Alouette development: dam and spillway; Alouette tunnel, penstock, power station and transmission line. Stave Falls development: intake dam, west wing dam, main dam, penstocks, power house, tailrace, hydraulic and electrical equipment. Ruskin development: main dam, headrace, penstocks, power house and hydraulic and electrical equipment.

CANADA. Hydro-Electric Progress in Canada During 1926. Can. Min. Jl., vol. 47, no. 6, Feb. 11, 1927, pp. 114-117. Developments in British Columbia, Alberta, Manitoba, Ontario, Quebec and Nova Scotia.

Progress of Hydro Development. Can. Engr., vol. 52, no. 2, Jan. 11, 1927, pp. 127-128. Total hydro-electric installations now exceed 4,500,000 h.p.; situation in various provinces; large projects planned.

QUEBEC. Developing Power on the Gatineau. Eng. News-Rec., vol. 98, nos. 4, 5 and 6, Jan. 27, Feb. 3 and 10, 1927, pp. 151-153, 194-198 and 234-241, 27 figs. Jan. 27: Initial 400,000-h.p. hydro-electric development in Quebec. Feb. 3: Heavy hauling for dam building done by tractor trains. Feb. 10: Analysis of construction plant for 5 concrete dams.

HYDRO-ELECTRIC PLANTS

RACK-CLEANING MACHINES. Machines for Cleaning the Gratings of Water Power Works. Eng. Progress, vol. 8, no. 1, Jan. 1927, pp. 18-19, 3 figs. Machines, made by firm of J. Voith, are of compact and light design necessitating only narrow platform to stand on, so that their application is possible even after completion of waterways; details of machines erected in Viereth power station on Main River.

RACKS AND PENSTOCK INTAKE. Rack Structure and Penstock Intake of the Isle Maligne Hydro-Electric Power Station, W. S. Lee. Eng. Jr., vol. 10, no. 1, Jan. 1927, pp. 9-12, 7 figs. Features of design and construction of rack structure and penstock intake of plant of Duke-Price Power Co. on Saguenay river.

I

ICE PLANTS

OIL-ENGINE DRIVEN. Increasing Ice Plant Profits by Oil Engine Drive, E. J. Kates. Oil Engine Power, vol. 5, no. 2, Feb. 1927, pp. 82-87, 7 figs. Analysis of costs and conditions showing superiority of oil engine above other power sources.

INDICATORS

EXPLOSION-ENGINE. The Optical Indicator as a Means of Examining Combustion in Explosion Engines, W. Morgan and A. A. Rubbra. Automobile Engr., vol. 17, no. 224, Jan. 1927, pp. 30-35 and (discussion) 36-38, 18 figs. Examines conditions prevailing in engine during initiation of ignition and combustion; with Watson-Dalby indicator, as used, measurements of mean effective pressure may be made with fair accuracy.

INDUSTRIAL MANAGEMENT

MINIMUM MANUFACTURING COST, DETERMINING. Minimum Cost Point in Manufacturing, D. S. Kimball. Mfg. Industries, vol. 13, no. 1, Jan. 1927, pp. 21-24, 2 figs. Author gives simple formula for determining in advance total production for various conditions that might prevail.

PROGRESSIVE ASSEMBLY. Progressive Assembly Gains Wider Recognition, F. L. Eidmann. Factory, vol. 38, no. 2, Feb. 1927, pp. 270-272, 10 figs. Management's increased interest in flow of production and in elimination of pools of material between operations is reflected in application of progressive assembly to many new industries.

RESEARCH AS AID TO. Management's Concern in Research, H. S. Person. Taylor Soc.—Bul., vol. 11, no. 5, Dec. 1926, pp. 261-267. Discussion of research as aid in establishing operating procedures, in making managerial decisions, and in developing science of management; methods of research in management.

INDUSTRIAL RELATIONS

CONCILIATION AND ARBITRATION. The Conciliation and Arbitration of Industrial Disputes. Int. Labour Rev., vol. 14, nos. 5 and 6, Nov. and Dec. 1926, pp. 640-659 and 833-860. Nature of conciliation and arbitration. Dec.: Examines critically various methods making up general machinery of conciliation and arbitration as actually in operation in various countries, and distinguishes as far as possible which of these methods would appear to be inherently sound. Jan.: Synthesis of certain methods of conciliation and arbitration which, in practice, appear to have given most satisfactory results.

INSULATORS, ELECTRIC

TESTING. Some Methods of Testing Insulators and Semi-Conductors, O. R. Randall. S. African Inst. Elec. Engrs.—Trans., vol. 17, Nov. 1926, pp. 257-263, 9 figs. Describe certain experimental methods which have been used to investigate way in which resistance of insulators is distributed for different materials.

INTEGRAPHS

CONTINUOUS. A Continuous Integraph, V. Bush, F. D. Gage and H. R. Stewart. Franklin Inst.—Jl., vol. 203, no. 1, Jan. 1927, pp. 63-84, 10 figs. Mechanical integraph has been developed which plots continuously integral of product of two functions; it uses principle of electrical integrating watthour-meter combined with moving table.

INTERNAL-COMBUSTION ENGINES

ATOMIZATION. Determining the Efficiency of Atomization by Its Fineness and Uniformity, J. Sauter. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 396, Jan. 1927, 23 pp., 2 figs.

DEVELOPMENTS, 1926. The Internal Combustion Engine in 1926, W. A. Tookey. Gas & Oil Power, vol. 22, no. 256, Jan. 6, 1927, pp. 73-74. Review of developments, including high-speed engine introduced by A. G. Mumford; improved 2-cycle engine by Vickers-Fetters; new vertical units of National Gas Engine Co., Michell crankless gas engine; developments by W. Beardmore & Co.; marine-engine progress; scientific research; fuel problems; Heat-Engine Trials Committee.

ELECTRO-MECHANICAL VALVES. Electro-Mechanically Operated Valves on Internal Combustion Engines. Gas & Oil Power, vol. 22, no. 257, Feb. 3, 1927, pp. 97-99, 3 figs.

GASEOUS EXPLOSIONS. Gaseous Explosions, G. Granger Brown and G. B. Watkins. Indus. & Eng. Chem., vol. 19, no. 2, Feb. 1927, pp. 280-285, 5 figs. Effect of fuel constitution on rate of rise of pressure.

SLOW-COMBUSTION FUELS FOR. The Use of Slow-Combustion Fuels in Explosion Engines (Au sujet de l'emploi dans les moteurs à explosion de carburants peu inflammables), P. Dumanois. Académie des Sciences—Comptes Rendus, vol. 183, no. 25, Dec. 20, 1926, pp. 1261-1263.

See also Diesel Engines; Gas Engines; Oil Engines.

IRON

DIRECT-PRODUCTION PROCESS. Making Iron Without Coke at Minnesota Mines, E. W. Davis. Iron Trade Rev., vol. 80, nos. 2 and 3, Jan. 13 and 20, 1927, pp. 133-135 and 144; and 197-200, 5 figs. Result of experiments at School of Mines Experiment Station, Univ. of Minnesota.

IRON CASTINGS

GASOLINE ENGINES. The Manufacture of Iron Castings for Petrol Engines, W. J. Molyneux. Foundry Trade Jl., vol. 35, nos. 543 and 544, Jan. 13 and 20, 1927, pp. 27-31 and 49-53, 33 figs. Explains methods commonly used in manufacture of such castings and shows novel devices of which author has made use during 10 years' experience. Coremaking; pouring cylinder castings.

J

JIGS

DESIGN AND USE. Jigs and Special Tools. Indus. Mgmt. (Lond.), vol. 14, no. 1, Jan. 1927, pp. 30-32, 2 figs. Points which should be kept in view in design of jigs are: (1) lightness, combined with stability and durability; (2) fool-proof, to insure safety and accuracy; (3) rapidity in handling; (4) simplicity for cleaning; advantages of jigs; form of laying out estimates.

L

LATHES

MULTIPLE-TOOL. Multiple-Tool Lathe for the Automotive Industry. Eng. Progress, vol. 8, no. 1, Jan. 1927, p. 5, 3 figs. Arrangement of tool rests renders lathe specially suitable for turning pieces of relatively great length; headstock is driven by single pulley; long tool rest, serving exclusively for longitudinal turning, slides on vees of front bed.

SCREW-CUTTING. A New Automatic Screw-Cutting Lathe. Machy. (Lond.), vol. 29, no. 741, Dec. 23, 1926, pp. 385-387, 5 figs. Lathe designed by A. Hilger, Ltd., to cut screws of highest order of accuracy commercially attainable.

LIFTING MAGNETS

IRON AND STEEL HANDLING. Lifting Magnets for Handling Iron and Steel, C. H. S. Tupholme. Metal Industry (Lond.), vol. 30, no. 5, Feb. 4, 1927, pp. 145-146, 2 figs. Types of lifting magnets; method of mounting; capacity of crane; rectangular and circular magnets.

FLOOD. Comparative Flood-Light Test, D. L. Bruner and W. T. Harding. Air Corps Information Cir., vol. 6, no. 571, Sept. 1, 1926, 13 pp., 21 figs. Object of test was to determine system of ground flood-light equipment best adapted for service use as night-flying equipment.

INDUSTRIAL. Intensity of Light and Speed of Vision Studied with Special Reference to Industrial Situations, C. E. Ferree and G. Rand. Illum. Eng. Soc. —Trans., vol. 22, no. 1, Jan. 1927, pp. 79-110, 11 figs.

LIGHTING

STREET. The Application of Remote Control to Modern Street Lighting, D. E. Wescott. Elec. Jl., vol. 24, no. 2, Feb. 1927, pp. 56-57. Deals with methods of remote control which would not have actual pilot circuit but would be so-called radio control by using other wires as means of sending out impulse, either by wired wireless or carried current; or by resonant control method; light sensitive-relay method; vacuum tube relay, operated by thermostat principle by radio wave.

Lumens Effective on a Street Surface, H. E. Lippman. Elec. Jl., vol. 24, no. 2, Feb. 1927, pp. 58-61, 5 figs. Presents table of constants for use in calculating lumens effective on street surface, and method of determining it.

Uniform Illumination for Streets, H. H. Ashinger. Elec. Jl., vol. 24, no. 2, Feb. 1927, pp. 77-79, 10 figs. Deals mainly with determination of candle-power distribution of light source which will provide above assumed theoretical ideal as to distribution of vertical intensity of light on street surface.

TRAFFIC. Slide Rule Chart Determines the Timing of Traffic Lights. Eng. News-Rec., vol. 98, no. 6, Feb. 10, 1927, p. 231, 1 fig. Gives stop-and-go light schedule for continuous travel along boulevard at any given rate of speed.

LOCOMOTIVE BOILERS

INTERNAL-COMBUSTION. The Internal-Combustion Boiler and Its Application to the Locomotive Engine, O. Brumler. Ry. Gaz., vol. 46, no. 3, Jan. 21, 1927, p. 84. Proposal, based upon experiments and test installations, for which theoretical efficiency as high as 99 per cent is claimed.

LOCOMOTIVES

CLINKER REMOVAL FROM FIREBOXES. Removal of Clinker from Locomotive Fireboxes, A. DePawlowski. Int. Ry. Congress Assn.—Bul., vol. 8, no. 12, Dec. 1926, pp. 1080-1083. Special devices for removal of clinker are divided into two groups: (1) shaking grates in which whole of bed of fire is from time to time given slight movement which gets rid of clinker; (2) certain sections of grate are arranged to tilt, thereby providing, when required, openings through which ashes and clinker can be pushed into ash pan; latter arrangement is suitable to all classes of coal and is widely used, especially in Europe.

INTERNAL-COMBUSTION. The Internal-Combustion Locomotive. Engineer, vol. 143, no. 3707, Jan. 28, 1927, pp. 96-97. In actual locomotives best-known practical examples are Lomonosoff designs for Russia; examples of hydraulic class are of smaller power, and are found in rail cars; they are of piston-turbo type or combined piston and gear type; combination systems using gaseous means for transmission; use of steam in conjunction with oil, as in Still engine; method of control.

OIL-ELECTRIC. Oil-Electric Locomotives, F. H. Brehob. Purdue Eng. Rev., vol. 22, no. 2, Jan. 1927, pp. 10-11 and 32, 4 figs. There are two sizes in service: 60-ton unit using one Ingersoll Rand 300-h.p., 600-r.p.m., 6-cylinder, 4-cycle solid-injection engine as prime mover; and 100-ton locomotive, which is similar except that it is equipped with two 300-h.p. generating sets, and with larger railway motors to take care of increased power and increased tractive effort.

LUBRICATING OILS

FLASH POINTS. Prediction of Flash Point of Blends of Lubricating Oils, E. W. Thiele. Indus. & Eng. Chem., vol. 19, no. 2, Feb. 1927, pp. 259-262, 2 figs. Method for making calculation, believed to be simple in application and sufficiently accurate for most practical purposes.

LUBRICATION

MECHANICAL SYSTEM. Lubricating System. Iron Age, vol. 119, no. 6, Feb. 10, 1927, p. 416, 2 figs. Mechanical lubricating system designed for positive lubrication with solidified transmission oil from centrally-controlled point.

M

MACHINE TOOLS

REPLACEMENT POLICY. What Are the Reasons for Replacing Obsolete Equipment? Am. Mach., vol. 65, nos. 20, 22, 24 and 26, Nov. 11, 25, Dec. 9, and 23, 1926, pp. 775-777, 853, 935-936 and 1011-1012. Nov. 11: Reasons for replacing obsolete equipment. Nov. 25: Period of time in which new equipment should pay for itself. Dec. 9: Steps to be taken in buying equipment. Dec. 23: Group vs. individual motor drive.

MAGNESIUM ALLOYS

FOUNDING. Magnesium (Le Magnesium), R. DeFleury. Révue de Métallurgie, no. 11, Nov. 1926, pp. 649-657.

MALLEABLE IRON

MANUFACTURE. Manufacture of Malleable Iron, A. E. White. Am. Soc. Steel Treating—Trans., vol. 11, no. 2, Feb. 1927, pp. 245-263, 20 figs.

MATERIALS HANDLING

PROGRESS, 1926. Material Handling's Progress During 1926, H. J. Payne. Factory, vol. 38, no. 1, Jan. 1927, pp. 156-157, 182, 184-186 and 188, 7 figs. Standardization of handling equipment was factor in year's developments, although in electric truck business trend has been away from standardization in strict sense; in connection with hand- and power-lift trucks, Hunt's laws for effective handling are more and more being put into practice; improvements in conveyors; increasing use of gasoline-powered industrial trucks and tractors; growing number of trailer installations; development in jib cranes.

STEEL WORKS. Modern Methods and Equipment for Handling Materials in Metallurgical Industry (Les procédés et appareils modernes de manutention), H. Drouot. Technique Moderne, vol. 18, no. 23, Dec. 1, 1926, pp. 707-714, 15 figs. Deals with blast-furnace changes, aerial cableways, cranes and bridges; special apparatus.

METALLOGRAPHY

MICROSCOPIC EXAMINATION OF METALS. Application of Microtome Methods to the Preparation of Soft Metals for Microscopic Examination, F. F. Lucas. Am. Inst. Min. & Met. Engrs.—Trans., no. 1654-E, Feb. 1927, 15 pp., 16 figs. Describes sectioning method for preparing soft metals for microscopic examination and illustrates its application; microtome method can be applied successfully to preparation of soft metals.

METALS

COLD WORKING OF. Materials Employed in Working of Metals (Quelques nouveautés dans le travail à froid des métaux), J. Cournot. Technique Moderne, vol. 18, no. 23, Dec. 1, 1926, pp. 753-758, 9 figs. Advantages and disadvantages of lead addition before drawing; pickling; tempering; duplex and triplex plate; material employed in cold working; control of products.

FLOW IN. Testing Flow in Metals at Various Temperatures, L. W. Spring, H. W. Maack and J. Kanter. Power, vol. 65, no. 6, Feb. 8, 1927, pp. 205-208, 4 figs. Deals with new machines designed for accurate testing of flow or creep in metals in which test specimens are subjected to maintained high temperatures and pressures prevalent in modern practice; materials having tensil strengths up to 250,000 lb. per sq. in. may be tested.

HARDENING. General Theory of Metallic Hardening, R. S. Dean and J. L. Gregg. Am. Inst. Min. & Met. Engrs.—Trans., no. 1644-E, Feb. 1927, 18 pp., 7 figs. Theory of hardening by binding of electrons at lattice discontinuities as proposed by Dean has been developed in considerable detail; authors' theory is that this binding of electrons results in formation of definite diatomic non-polar molecules.

SPECIFIC HEAT. On the Latent Heat of Fusion of Several Metals and Their Specific Heats at High Temperatures, S. Umino. Tôhoku Imperial Univ.—Sci. Repts., vol. 15, no. 5, Nov. 1926, pp. 597-617, 11 figs. Gives melting point for iron, chromium, etc. (In English.)

MILLING CUTTERS

DESIGN. Modern Milling Cutters, S. H. Bailey. Machy. (Lond.), vol. 29, nos. 741 and 744, Dec. 23, 1926, and Jan. 13, 1927, pp. 401-404 and 476-479, 10 figs. Design and application. Dec. 23: Variations of tooth form; cutters with spiral or helical teeth; inserted tooth cutters. Jan. 13: Elimination of chatter marks; arbors and keys; mounting special steadies; work support; maintenance of cutters.

MINE HAULAGE

UNDERGROUND ROPE. Underground Rope Haulages and Design, F. Beckett. Iron & Coal Trades Rev., vol. 114, no. 3071, Jan. 7, 1927, pp. 10-11, 3 figs. Reviews progress in design of haulage machinery from earliest days of mining, and then deals more fully with present-day design; comparison of types; advantages of double-helical gear; worm types. Paper read before Nat. Assn. Colliery Mgrs.

MINERAL DEPOSITS

QUEBEC. The Mineral Deposits of the Rouyn-Harricana Region in Western Quebec, Theo. C. Denis. Eng. Jl., vol. 10, no. 2, Feb. 1927, pp. 63-68, 5 figs. Physiography and geology; occurrence of mineral deposits and present extent of development.

MINES

ELECTRIC CIRCUITS, SECTIONALIZING. Sectionalizing of Mine Circuits, E. L. Hough. Can. Min. Jl., vol. 48, no. 3, Jan. 21, 1927, pp. 53-56, 5 figs. Character of mine electrification; advantages of sectionalizing mine distribution systems; automatic reclosing feeders; details of equipment and its operation.

MINING

DEVELOPMENTS. Mining Practice Covers Wide Range, G. J. Young. Eng. & Min. Jl., vol. 123, no. 4, Jan. 22, 1927, pp. 146-149. Recent books; open-pit equipment; shaft sinking; drilling.

MINING INDUSTRY

ONTARIO. The Metal Mining Industry of Northern Ontario, W. R. Rogers. Eng. Jl., vol. 10, no. 2, Feb. 1927, pp. 69-74, 4 figs. Historical review of developments of industry.

MOULDING METHODS

CHAPLETS FOR HEAVY CASTINGS. Chaplets for Heavy Castings, I. Lamoreux. Foundry Trade Jl., vol. 35, no. 546, Feb. 3, 1927, pp. 93-94, 7 figs.

SHIP'S STERN FRAME. Mould Stern Frame in British Shop, H. V. Fell. Foundry, vol. 55, no. 3, Feb. 1, 1927, pp. 90-95, 44 figs. Method used when moulding large steel casting, serves to emphasize growing tendency of American and British foundry practice to drift apart; in England, pattern work is held to minimum; moulder is expected to do nearly everything himself; time is not all-important fetish, as in America; industrial conditions in American foundries have resulted in development of simplified practice.

THICKNESSING. Some Thicknessing Jobs, B. Shaw and J. Edgar. Foundry Trade Jl., vol. 35, no. 543, Jan. 13, 1927, pp. 35-36, 9 figs. Thicknessing, in its application to moulding, means use of some medium in mould or on core which will define thickness of metal which casting is required to have; gives practical examples.

VENTING. Proper Venting Reduces Losses, P. R. Ramp. Iron Age, vol. 119, no. 5, Feb. 3, 1927, pp. 347-349, 5 figs. Cinder beds are used to advantage in moulding pits; vent rod produces better vent than wire.

MOULDS

SKIN-DRYING. Skin-Drying Moulds. Mech. World, vol. 81, no. 2089, Jan. 14, 1927, p. 24, 4 figs. Purpose of skin-drying is to give greensand moulds hard surface, almost without moisture; it is useful for light work; shows good method of drying geensand moulds in quantities.

N

NICKEL

PROPERTIES. Position of Nickel in Modern Metallurgy, W. R. Barclay. Metal Industry (Lond.), vol. 30, no. 1, Jan. 7, 1927, pp. 25-29, 3 figs. Summarizes place of nickel in modern metallurgy and nature and properties of its more important alloys: it is one of metals which, in its tensile properties, can rival in strength alloys of steel, and its non-corroding qualities make it of special value in many applications of modern high-power and electrical engineering.

O

OIL ENGINES

COLD-STARTING. A Cold-Starting Heavy-Oil Engine. Engineer, vol. 143, no. 3706, Jan. 21, 1927, pp. 80-81, 3 figs. Single-cylinder horizontal two-stroke-cycle type designed for output of 50 b.h.p. when running at normal speed of 300 r.p.m.

OPERATION. Problems Regarding Oil Engine Operation, D. I. Fagnan. South. Power Jl., vol. 45, no. 2, Feb. 1927, pp. 41-45. Discusses difficult problems confronting operators.

SOLID-INJECTION. The Effect of Reduced Intake-Air-Pressure and of Hydrogen on the Performance of a Solid-Injection Oil Engine, G. F. Mucklow. Roy. Aeronautical Soc.—Jl., vol. 31, no. 193, Jan. 1927, pp. 17-48 and (discussion) 48-59, 16 figs.

OIL FUELS

GASIFICATION. Gasifying Oil Fuels. Gas & Oil Power, vol. 22, no. 257, Feb. 3, 1927, pp. 101-102, 2 figs. Recent development, known as Goldsbrough process, by which, it is claimed, fuel oils can be completely gasified.

OIL SHALES

COKING. Coking of Oil Shales, W. L. Finley and A. D. Bauer. U.S. Bur. of Mines—Tech. Paper, no. 398, 1926, 11 pp., 6 figs. Tendency of shales to coke; mixing coking and non-coking shales; mixing coking shale with spent shale; use of steam in retort; oxidation of shale; extraction of shale with organic solvents.

OPEN-HEARTH FURNACES

DESIGN. Open-Hearth Furnace Construction, C. W. Veach. Blast Furnace & Steel Plant, vol. 15, no. 2, Feb. 1927, pp. 92-93. It is desirable to know fusing point of various refractories entering into furnace construction; kind and quality of brick stressed; chrome ore used.

DEVELOPMENTS. Developments in the Open-Hearth Process, B. M. Larsen. Blast Furnace & Steel Plant, vol. 15, no. 1, Jan. 1927, pp. 10-15, 1 fig. Review of furnace construction and operation; metallurgical practices (with chemical equations). Bibliography.

ORE DRESSINGS

PROGRESS, 1926. Progress in Milling and Flotation Practice, 1926, C. S. Parsons. Can. Min. Jl., vol. 47, no. 4, Jan. 28, 1927, pp. 68-69. Developments in coarse crushing, fine grinding and classification, jigs, tables, flotation and thickening and filtration.

OXY-ACETYLENE WELDING

TESTING WELDS. Testing Gas Welds, H. L. Whittemore. Welding Engr., vol. 12, no. 1, Jan. 1927, pp. 38-40. Review of present testing methods with suggestions for testing devices and further research in welding problems.

P

PAPER MANUFACTURE

CURRENCY PAPER. Research on the Production of Currency Paper in the Bureau of Standards Experimental Paper Mill, M. B. Shaw and G. W. Bicking. Paper Mill, vol. 50, no. 3, Jan. 15, 1927, pp. 16 and 35-40. Result of investigation to determine durability factors of paper suitable for currency use, with view to increasing wearing qualities and thereby prolonging life of paper money.

SULPHITE COOLING. Neutral and Alkaline Sulphite Cooking. Paper Industry, vol. 8, no. 11, Feb. 1927, pp. 1914a-1917. Many endeavours made to substitute soda or ammonia for lime and magnesia in sulphite process.

PAPER MILLS

DRIVES. Advances in Paper Mill Drives, D. H. Knuckey. Paper Industry, vol. 8, no. 11, Feb. 1927, pp. 1904-1911, 9 figs. Call attention to beneficial results of intensive research and practical engineering work carried on in conjunction with manufacturers of paper; paper machine drives; control equipment; drives for supercalenders and platers; general equipment.

PATENTS

APPLICATION. Patent Application, E. L. Francis. Automobile Engr., vol. 17, no. 224, Jan. 1927, pp. 22-23. Comparison between procedure in Great Britain and United States.

DESIGN AND MECHANICAL. Design and Mechanical Patents, L. T. Parker. Machy. (N.Y.), vol. 33, no. 6, Feb. 1927, pp. 438-440. Distinction between these two classes and important facts about design patents.

PAVEMENTS, ASPHALT

HYDRATED LIME AS FILLER. The Value of Hydrated Lime as a Filler in Asphalt Mixtures. Contract Rec., vol. 41, no. 3, Jan. 19, 1927, pp. 61-66, 10 figs. Gives promise of being particularly well-adapted for use as filler both on account of extreme fineness and surface texture; recommendations of paving engineers.

PAVEMENTS, BRICK

THIN BRICK. Investigation of Thin Paving Brick, E. F. Kelley. Eng. News-Rec., vol. 98, no. 3, Jan. 20, 1927, pp. 116-117, 2 figs. Most important conclusion is that 2½-in. brick of quality used in tests, when supported by adequate base, are satisfactory for pavements carrying heavy traffic. Paper read before Am. Road Bldrs'. Assn.

PAVEMENTS, CONCRETE

CAPPING SPECIFICATIONS. Alumina Cement Caps Successful on Hardened Concrete Specimens, O. V. Adams. Eng. News-Rec., vol. 98, no. 4, Jan. 27, 1927, p. 153. They show good adherence to specimens, may be stored in water and permit tests to be made sooner than with caps of other materials.

POWER TRANSMISSION

TORQUE CONVERTER. The Torque Converter, G. Constantinesco. Roy. Soc. of Arts—Jl., vol. 75, no. 3866, Dec. 24, 1926, pp. 148-170 and (discussion) 170-177, 13 figs. Details of machine in four dimensions developed by author; it produces instant and automatic torque always equal to resistance encountered while primary motor maintains its torque and speed nearly invariably; practical applications of machine and new possibilities opened up in application of a.c. motors, especially for electric motors where heavy tractive force is required at starting.

PRESSWORK

PRESSURES FOR. Pressures for Blanking, Punching, Drawing, Etc., C. W. Lucas. Mech. World, vol. 81, no. 2091, Jan. 28, 1927, pp. 65-66. 6 figs. Determining shearing pressures; pressure requirements for gang punches; calculating drawing die pressures. Paper presented before Nat. Pressed Metal Soc.

PUMPS, CENTRIFUGAL

ACCESSIBILITY OF PARTS. The Value of Accessibility, D. G. McNair. Colliery Eng., vol. 4, no. 35, Jan. 1927, pp. 23-24, 2 figs. Advantages of providing easy access to working parts of centrifugal pumps.

DESIGN AND APPLICATION. Recent Developments in the Design and Application of Centrifugal Pumps. Water & Water Eng., vol. 29, no. 337, Jan. 20, 1927, pp. 23-31. Discussion of paper by Hallam; published in vol. 27, p. 485, of same journal.

PUMPS

ELECTRIC MOTORS FOR. Pump Drives Must Be Selected With Due Regard to Peculiar Conditions of Service, E. Gealy. Eng. & Min. Jl., vol. 123, no. 5, Jan. 29, 1927, pp. 196-198, 6 figs. Economies of electric motors make them highly desirable; moisture, temperature, dirt, dust, acid and alkali fumes cause operating troubles unless properly guarded against.

PYROMETRY

DEFINITION OF TERMS. Definitions of Pyrometric Terms. Glass Industry, vol. 8, no. 2, Feb. 1927, p. 31. Standardized definitions of pyrometric terms, as presented by Industrial Group of Association of Scientific Apparatus Makers, are recommended for general use.

R

RADIATION

THERMAL, MEASUREMENTS. The Thermoradiometer, M. Oyama. Elec. Jl., vol. 24, no. 1, Jan. 1927, pp. 26-29, 14 figs. Instrument to measure intensity of thermal radiation in same way as illuminometer is used to measure intensity of light; examples of its application.

RADIO-TELEGRAPHY

PROGRESS. Radio-Telegraphy and Radio-Telephony, L. B. Turner. Instn. Elec. Engrs.—Jl., vol. 65, no. 361, Jan. 1927, pp. 131-136, 3 figs. In survey of recent wireless progress, new and improved uses of triodes figure largely; Rugby station; transoceanic telephony; short waves; beam stations; broadcasting.

RAILS

CORRUGATION. Effect of Abrasion and Compression on Rail Corrugation, Ch. Fremont. Elec. Ry. Jl., vol. 69, no. 7, Feb. 12, 1927, pp. 283-285, 8 figs. Energy that is stored by elastic deformation of axle causes de-torsion and consequent abrasion; compression causes structural changes in rail metal. Translated from Génie Civil, Nov. 13, 1926.

RAILWAY SIGNALLING

AUTOMATIC BLOCK. Committee IV—Direct-Current Automatic Block Signalling. Am. Ry. Assn., Signal Section—Proc., vol. 24, no. 3, Feb. 1927, pp. 420-429. D.c. vibrating highway crossing bell; minimizing effect of lightning and of foreign current on d.c. track circuits; prevention of sweating.

Committee VIII—Alternating Current Automatic Block Signalling. Am. Ry. Assn., Signal Section—Proc., vol. 24, no. 3, Feb. 1927, pp. 587-620. Rectifiers for signal systems; induction interference of a.c. circuits and supply lines for signals and train control with communication circuits; protection from lightning.

CROSSING PROTECTION. Unique Crossing Signals, J. A. Peabody. Ry. Age, vol. 82, no. 3, Jan. 15, 1927, pp. 233-234, 3 figs. City of DeKalb, Ill., in conjunction with Chicago & North Western, has unique installation of crossing protection signals at point where two streets intersect at right angles with each other and at approximately 45 deg. with crossing of railroad.

INTERLOCKING. Committee II—Mechanical Interlocking. Am. Ry. Assn., Signal Section—Proc., vol. 24, no. 3, Feb. 1927, pp. 379-399. Requisites for mechanical interlocking machine; compensation of pipe lines for operation of mechanical units; mechanical interlocking machines.

LENSES AND REFLECTORS. Lenses and Reflectors for Railroad Service, F. Benford. Gen. Elec. Rev., vol. 30, no. 2, Feb. 1927, pp. 102-104, 4 figs. Optics of Fresnel lenses; three types and their characteristics; rated according to merits; optics of special railroad-yard floodlight; high collecting and projecting efficiency obtained.

SPECIAL LAYOUTS. Signalling Special Layouts, F. H. Bagley. Ry. Signalling, vol. 20, no. 2, Feb. 1927, pp. 49-56, 30 figs. Seaboard met local operating problems at certain places by modifying signal arrangement.

RAILWAYS

TRAIN RESISTANCE. Notes on Train Resistance, C. F. D. Marshall. Ry. Engr., vol. 48, no. 565, Feb. 1927, pp. 73-77 and 80, 6 figs. Supplementary notes to series of articles published in 1924 and subsequently issued in book form; effect of acceleration and gradients; resistance of engines.

REDUCTION GEARS

HEAVY SERVICE. New Reduction Gear Units for Heavy Service. Iron Age, vol. 119, no. 6, Feb. 10, 1927, p. 439, 1 fig. Use of 7½-deg. single helical gears and of Timken roller bearings are features of series of single reduction-gear units placed upon market by R. D. Nuttall Co., Pittsburgh; there are 6 units in series, designated as MS and MR, and they cover range of from 150 to 2,000 h.p.

REFRIGERANTS

SOLID CO_2. Solid Carbon Dioxide a New Commercial Refrigerant, D. H. Killeffer. Indus. & Eng. Chem., vol. 19, no. 2, Feb. 1927, pp. 192-195, 2 figs. Advantage was taken of peculiarities of solid carbon dioxide by developing methods for its use as commercial refrigerant in competition with water ice.

REFRIGERATING PLANTS

BRINE, INFLUENCE OF. Quality of Brine Influences Refrigerating Plant Records, F. P. MacNeil. Power, vol. 65, no. 6, Feb. 8, 1927, pp. 203-204, 1 fig.

REFRIGERATION

REFRIGERATOR TEMPERATURES. Refrigerator Temperatures, J. E. Starr. Ice & Refrigeration, vol. 72, no. 1, Jan. 1927, pp. 86-87. Method of finding inside temperatures of refrigerators under atmospheric changes; effects of good insulation on amount of refrigeration required and on refrigerator temperatures; theory of ice-box construction as to heat transmission.

RESEARCH

ADVANTAGES TO INDUSTRY. Research the Beacon of Progress, W. Sparragen. Factory, vol. 38, no. 2, Feb. 1927, pp. 275-277, 290, 292, 394, 398 and 402, 5 figs. What research means to industry in practical gains; examples of practical use of research.

MANUFACTURERS' ASSOCIATION. The Manufacturers' Research Association, R. L. Tweedy. Taylor Soc.—Bul., vol. 11, no. 5. Dec. 1926, pp. 275-281 and (discussion) 281-283. Organization of Massachusetts manufacturing plants which enjoys benefits of joint investigation of common managerial problems.

RESINS

PAPER MANUFACTURE. Resins in Paper Making, J. Campbell. Paper Industry, vol. 8, no. 11, Feb. 1927, pp. 1912-1913, 2 figs. Effect of resin in wood in preventing penetration of strong cooking acid into chips; ways in which better penetration may be obtained by addition of certain salts which will, of themselves, or may decompose to salts which increase wetting of resin by strong cooking liquor.

ROADS, CONCRETE

DEVELOPMENTS. Recent Developments in Concrete Road Construction, W. E. Barker. Good Roads, vol. 70, no. 1, Jan. 1927, pp. 19-23, 4 figs. Changes in consistency; mixer development; aggregate proportioned more accurately; central mixing plants; machines replace hand finishing; changes in slab thickness; scientific proportioning; curing.

PROBLEMS. Concrete Roads in Eight Countries. Concrete & Constr. Eng., vol. 21, no. 9, Sept. 1926, pp. 635-649, 6 figs. Reports to International Roads Congress, held at Milan, Italy, dealing with practically every aspect of concrete road problems.

ROCK CRUSHING

HEAT TREATMENT AS AGENT IN. Heat Treatment as an Agent in Rock-Breaking, B. W. Holman. Instn. Min. & Met.—Bul., no. 268, Jan. 1927, pp. 1-16, 6 figs. It has been demonstrated that if many forms of quartz are heated at suitable rate to temperature between 560 and 600 deg. cent. and properly quenched, they undergo remarkable physical change; they may be rendered so friable that material from rock-breaker can, after such heat treatment, be reduced to powder with finger and thumb; describes small rotary furnace to treat one ton per day in such way; indicates possible application of heat treatment to elimination of stamp and disk crushers with certain ores, and increasing output of ball mills and tube mills.

ROLLING MILLS

BEAMS. Material Flow in the Rolling of Beams, N. Metz. Blast Furnace & Steel Plant, vol. 15, no. 2, Feb. 1927, pp. 82-87, 38 figs. In order to determine flow of metal when being rolled, method has been devised in which threaded test pieces are imbedded in block of steel and this block rolled exactly as in practice. Translated from Stahl u. Eisen, Nov. 16, 1927, pp. 1577-1582.

ELECTRIC DRIVE. Hot Rolling. Electric Control of Rolling Mills (Le travail à chaud. Les méthodes actuelles de commande électrique des trains de laminoirs), J. Lévy. Technique Moderne, vol. 18, no. 23, Dec. 1, 1926, pp. 751-752, 4 figs. Discusses drives by d.c. and a.c. motors.

ELECTRICAL EQUIPMENT. Electric Equipment for Steel Plants, A. F. Kenyon. Blast Furnace & Steel Plant, vol. 15, no. 1, Jan. 1927, pp. 37-39 and 46, 10 figs. Progress in design and construction of motors for driving mills of various types; equipment for mills at various steel plants.

EQUIPMENT. Improvements in Rolling Mill Equipment, F. C. Roberts, Jr. Blast Furnace & Steel Plant, vol. 15, no. 1, Jan. 1927, pp. 29-31, 6 figs. Factors controlling rolling-mill construction; changes to various types of mills indicate material advances; pilger mill attracting much attention.

RUBBER

LATHE WORK WITH. Lathe Work with Soft Rubber. India-Rubber Jl., vol. 73, no. 4, Jan. 22, 1927, pp. 11-13. General and practical account of lathe-work methods as applied to soft rubber articles.

ELECTRODEPOSITION. Electrodeposition of Rubber. Brass World, vol. 23, no. 1, Jan. 1927, pp. 9-11, 3 figs. New process of rubber-goods manufacture; latex compounding; continuous production of rubber goods; advantages and applications.

S

SAND, MOULDING

RECLAMATION. Sand System Yields Economies, B. Finney. Iron Age, vol. 119, no. 6, Feb. 10, 1927, pp. 413-416, 7 figs. Conservation of floor space, reduction of labour costs and substantial saving in amount of new sand purchased each year have been made possible in Lima plant of Ohio Steel Foundry Co. by successful operation of sand-reclaiming system; all handling of sand by hand has been eliminated and, aside from one minor operation, crane service in relation to sand handling has been made unnecessary.

SAWMILLS

ELECTRIC DRIVE. The Lay-Out of a Modern Saw Mill, M. Unterweger. Eng. Progress, vol. 8, no. 1, Jan. 1927, pp. 9-11. Advantages and disadvantage of individual, group and main drive.

TRANSPORTATION IN. Disposition of Transport in Saw Mills, U. Philipp. Eng. Progress, vol. 8, no. 1, Jan. 1927, pp. 14-16, 4 figs. Acceleration and mechanicalizing of transportation reduce total working expenses.

SAWS

CIRCULAR, GUARDING. Guarding the Circular Saw, E. G. Sheibley and C. G. Chipchase. Nat. Safety News, vol. 15, no. 1, Jan. 1927, pp. 31-35, 7 figs. Present status of problems in California.

SEAPLANES

CIVIL. The Development of Civil Marine Aircraft. Instn. Aeronautical Engrs.—Proc., no. 20, 1926, pp. 7-29 and (discussion) 30-37, 14 figs.

SEWAGE DISPOSAL

ACTIVATED SLUDGE. Notes on the Role of Iron in the Activated Sludge Process, A. Wolman. Eng. News-Rec., vol. 98, no. 5, Feb. 3, 1927, pp. 202-204, 2 figs. German, American and Canadian studies indicate possible increased air efficiency by use of iron.

SLUDGE. Some Chemical Characteristics of Sewage Sludge, S. L. Neave and A. M. Buswell. Indus. & Eng. Chem., vol. 19, no. 2, Feb. 1927, pp. 233-234. Use of volatile and fixed carbon determination to distinguish between fresh and digested sludge does not appear to be feasible; it is useful test in research study of character of sludge; grease and nitrogen determination; carbohydrates; peptization.

SLUDGE DIGESTION. Improving Sewage Sludge Digestion, W. Rudolfs. Pub. Works, vol. 58, no. 1, Jan. 1927, pp. 19-23, 1 fig. Suggestions for applying in practice results obtained by investigations made at New Jersey Agricultural Experiment Station.

SILVER MINING

ONTARIO. Silver Mining in Ontario, J. A. McRae. Can. Min. Jl., vol. 48, no. 1, Jan. 7, 1927, p. 11. Summary of annual output of silver from northern Ontario and average price of commercial bar silver which has prevailed since 1904.

SMOKE

ABATEMENT. Smoke Abatement in St. Louis, W. G. Christy. Power, vol. 65, no. 6, Feb. 8, 1927, pp. 197-198, 1 fig. Comprehensive campaign being carried on by Citizens' Smoke Abatement League; average soot fall for December found to be over 900 tons per sq. mi.; education and co-operation keynote.

ABATEMENT. Municipal Housing Schemes and Smoke Abatement, E. D. Simon and M. Fitzgerald. Domestic Eng. (Lond.), vol. 46, no. 11, Nov. 1926, pp. 231-235. New methods adopted by certain local authorities in England; attitude of local authorities towards smoke problem and views on new methods adopted; opinions of tenants.

SNOW REMOVAL

HIGHWAYS. Economy of Snow Removal from Highways, W. A. VanDuzer. Mun. & County Eng., vol. 71, no. 5, Nov. 1926, pp. 273-274. Account of Pennsylvania system. Paper presented before Am. Assn. of State Highway Officials.

METHODS AND EQUIPMENT. Snow Removal in Detroit. Pub. Works, vol. 57, no. 11, Dec. 1926, pp. 410-412, 1 fig. Equipment owned and hired; obtaining and directing labour; preparing snow map; methods of snow moving and snow removal. Paper read before Am. Soc. Mun. Improvements.

SPEED REDUCERS

TYPES AND APPLICATIONS. Speed-Reducer Types and Their Application to Industrial Requirements. Paper Trade Jl., vol. 84, no. 2, Jan. 13, 1927, pp. 48-52, 17 figs. Deals with different types of speed reducers most suitable and economical for various kinds of industrial service; spur-gear, herringbone-gear and worm-gear speed reducers; uses and applications.

SPRINGS

AUTOMOBILE. Automobile Springs (Automobilwagenfedern), W. Schlachter. Motorwagen, vol. 29, no. 27, Sept. 30, 1926, pp. 637-642, 10 figs. Calculation of stress of front springs on cars with 4-wheel brakes.

STANDARDIZATION

DEVELOPMENTS. Standardization, R. Bärmig. Eng. Progress, vol. 7, no. 11, Nov. 1926, pp. 305-308, 5 figs. Reviews standardization movements in all industrial countries.

Report of German Industrial Standards Committee (N.D.I. Mitteihungen), W. Reichardt. Maschinenbau, vol. 5, no. 22, Nov. 18, 1926, pp. 1055-1056. Proposed standards for grip chucks, feed chucks, lock jaws for lathes; refractory bricks.

ELECTRICAL. Electrical Standardization, 1926, P. Good. Instn. Elec. Engrs.—Jl., vol. 65, no. 361, Jan. 1927, pp. 137-142. Report on progress of work in England; short summary of history and progress of co-operative industrial electrical standardization in some other countries.

PREFERRED NUMBERS. Preferred Numbers, A. Herb. Mech. Eng., vol. 49, no. 1, Jan. 1927, pp. 35-36, 2 figs. Standardization based on calculation; application of preferred numbers means simplification; examples; difficulties encountered in introducing preferred numbers through adhering to old methods; preferred numbers generally applicable.

STEAM

HIGH-PRESSURE. Recent Experiments on the Properties of Steam at High Pressures, H. L. Callendar. Roy. Soc. of Arts—Jl., vol. 75, no. 3870, Jan. 21, 1927, pp. 245-258, 7 figs. Measurement of pressure; critical temperature and volume; adiabatic equation for dry steam; total heat of water and steam; specific heat of superheated steam.

HIGH-PRESSURE. Recent Experiments on the Properties of Steam at High Pressures, H. L. Callendar. Engineering, vol. 122, no. 3177, Dec. 3, 1926, pp. 681-682, 5 figs. Account of author's experiments; in general, results show that at high superheats Callendar tables were very accurate, and under these conditions properties of steam agreed with simple Joule-Thomson equations. Lecture before Roy. Soc. of Arts.

The Economic Value of Increased Steam Pressure, H. L. Guy. Engineer, vol. 142, nos. 3696 and 3697, Nov. 12 and 19, 1926, pp. 534-537 and 561-563, 18 figs. Considers how far increase of steam pressure affects efficiency of operation; some of its effects on character and cost of individual units comprising whole plant, and what guidance can be obtained in selection of pressure appropriate to any particular case. Paper read before Instn. Mech. Engrs. See also Engineering, vol. 122, no. 3175, Nov. 19, 1926, pp. 643-646, 12 figs.

HIGH PRESSURES AND TEMPERATURES. The Use of Very High Steam Pressures and Temperatures. Eng. & Boiler House Rev., vol. 40, no. 8, Feb. 1927, pp. 384-386, 1 fig. New data from Continent of great importance to boiler house.

PURIFICATION. The Purification of Steam. Eng. & Boiler House Rev., vol. 40, no. 6, Dec. 1926, pp. 292 and 295-296, 3 figs. Instructive experiences indicating possibilities of increased economy and efficiency by giving closer attention to question of removing solids carried over in saturated steam.

RESEARCH. Progress in Steam Research. Mech. Eng., vol. 49, no. 2, Feb. 1927, pp. 160-163, 6 figs. Contains following contributions: Report on Progress in Steam Research at the Massachusetts Institute of Technology, L. B. Smith; Report on Progress in Steam Research at the Bureau of Standards, E. S. Mueller; Work on Pressure Standard at Massachusetts Institute of Technology, F. G. Keyes; Comparison with Formulations, R. C. H. Heck.

STEAM ACCUMULATORS

RESULTS FROM. Results from Steam Accumulators, R. L. Fletcher. Gas Age-Rec., vol. 58, no. 26, Dec. 25, 1926, pp. 912 and 918. Review of application of accumulator.

STEAM ENGINES

EXHAUST EJECTORS FOR. Exhaust Ejectors for Steam Engines, W. Turnwald. Power, vol. 64, no. 26, Dec. 28, 1926, pp. 989-990, 4 figs. Feasibility of using kinetic energy of exhaust to create vacuum is real; success of experiments indicates possibility of lower steam consumption and reduced first cost.

STEAM RATES AND THERMAL EFFICIENCY. Steam Rates and Thermal Economy. Power, vol. 64, no. 22, Nov. 30, 1926, p. 802. Points out that it is becoming more and more essential that thermal efficiency be quoted in addition to steam rates in comparing performance; effect of reheating.

WATER ENTRY INTO CYLINDERS. Preventing the Entry of Water into Engine Cylinders, I. L. Kentish-Rankin. Steam Power, vol. 6, no. 1, Jan. 1927, pp. 5-6, 8 and 14, 4 figs. Precautions in starting up and in shutting down; backing up from exhaust; problem of surface condenser; claims that steam separator is no more dependable than its trap.

STEAM METERS

FLOW METERS. Using Meters Improves Efficiency and Reduces Investments, H. W. Gochnauer. Power, vol. 65, no. 4, Jan. 25, 1927, pp. 118-121, 6 figs. In author's plant, steam flow meters were installed in 1921; by using information made available by these meters, it has been possible to increase boilers' rating greatly and at same time improve evaporation per pound of coal on average of about 33 per cent.

STEAM PIPES

COVERING. How Thick Should Pipe Covering Be? C. C. Hermann. Power, vol. 65, no. 2, Jan. 11, 1927, pp. 49-50. Greater thickness gives slightly greater heat savings, but there is limit beyond which extra saving will not warrant additional investment.

HEAT LOSSES. The Loss of Heat from the External Surface of a Hot Pipe in Air, E. Griffiths. Engineering, vol. 123, no. 3182, Jan. 7, 1927, pp. 1-4, 15 figs. Describes two electrically-heated pipes employed at National Physical Laboratory and shows that results obtained agree fairly closely with each other, with results obtained at low temperatures by steam-condensation method, and also with results previously obtained from 9-in. pipe.

JOINTS. The Luc-Denis Articulated Steam Pipe Joint. Mar. Engr. & Motorship Bldr., vol. 49, no. 592, Dec. 1926, p. 467, 1 fig. Particulars of novel type of joint, emanating from France, which has been successfully used for high-pressure, high-temperature steam pipe lines.

PRESSURE DROP. Finding the Pressure Drop in Piping, F. C. Evans. Power, vol. 64, no. 25, Dec. 21, 1926, p. 947, 1 fig. Chart designed to assist in making power-plant piping study described by author in Power, Nov. 2, 1926.

STEAM POWER PLANTS

COMBUSTION EQUIPMENT. Pulverized Coal Equipment Shows Steady Progress. Power Plant Eng., vol. 31, no. 2, Jan. 15, 1927, pp. 106-118, 21 figs. Data on pulverized-coal equipment; progress in stoker design; furnace-wall design; and air heaters.

COST SYSTEM FOR. A Cost System for Steam Power Plants, P. S. Austen. Mfg. Industries, vol. 13, no. 1, Jan. 1927, pp. 45-48, 2 figs. Practical system which is adaptable to both small- and large-scale operations.

DEVELOPMENTS. How the Steam Power Plant Is Keeping Up-to-Date, C. H. Berry. Eng. News-Rec., vol. 98, no. 2, Jan. 13, 1927, pp. 88-91, 4 figs. Steam the dominant medium for power generation; major steam-plant losses and methods of attacking them; industrial-plant economy secured by combining power and heating requirements.

DESUPERHEATERS. New Field for Desuperheaters, B. N. Broido. Power, vol. 64, no. 22, Nov. 30, 1926, pp. 803-805, 3 figs. By using desuperheater and reducing valve in tie line between new and old sections of plant, emergency connection can be maintained while taking advantage, in new section, of recent advances in steam temperature and pressure; operation of new type of desuperheater in which no water comes in contact with steam.

POWER AND HEATING REQUIREMENTS. The Relation Between Power and Heating Requirements in Power Plants, C. L. Hubbard. Nat. Engr., vol. 31, no. 2, Feb. 1927, pp. 45-50, 4 figs. Several methods suggested for improving heat balance in various cases for most efficient utilization of exhaust steam and greatest overall economy.

STEAM TURBINES

BACK-PRESSURE. An Improved Back-Pressure Turbine. Engineer, vol. 143, no. 3705, Jan. 14, 1927, p. 56, 4 figs. partly on p. 46. Designed and built by English Elec. Co. for Dhrangadhra State Chemical Works, machine exhausts against back-pressure of 30 lb. per sq. in. and is designed to give output of 675 kw. at speed of 3,000 r.p.m.

BLADE MATERIALS. Turbine Blade Materials. Elecn., vol. 97, no. 2531, Dec. 3, 1926, pp. 645-646, 2 figs. Notes on their development; effect of modern steam conditions; causes of deterioration.

BLEEDER. Calculating the Characteristics of the Extraction Turbine, R. R. Walden. Power, vol. 65, no. 5, Feb. 1, 1927, pp. 170-172, 1 fig. Why an extraction turbine has greater throttle flow; selecting bleeding stages; determining increase in throttle flow to offset steam bled; proportion bled for feed heating; effect of extraction on steam rate and efficiency.

Steam Turbines (Turbines à vapeur), A. Cordier. Assn. des Ingénieurs sortis de l'Ecole Polytechnique de Bruxelles—Bul. Technique, vol. 22, no. 3, 1926, pp. 97-116, 5 figs. Reheating of feedwater by steam bleeding.

DEVELOPMENTS. Analysis of Present-Day Turbine Installations. Power Plant Eng., vol. 31, no. 1, Jan. 1, 1927, pp. 42-45, 2 figs. Comments on pressures and temperatures employed, use of reheat, turbine arrangement and extraction for feedwater heating.

Bigger and Better Turbines Ahead, A. G. Christie. Power Plant Eng., vol. 31, no. 1, Jan. 1927, pp. 40-42, 1 fig. Developments show trend toward higher pressures and temperatures, reheat and extraction.

Developments in Steam Turbine Construction. Power Plant Eng., vol. 31, no. 2, Jan. 15, 1927, pp. 138-143, 11 figs. Presents statements by different manufacturers.

80,000-Kw. Further Details of Hudson Avenue 80,000-Kilowatt Turbine Unit. Power, vol. 65, no. 2, Jan. 11, 1927, pp. 52-54, 6 figs.
80,000-Kilowatt Turbine Unit. Power, vol. 64, no. 22, Nov. 30, 1926, pp. 815-818, 4 figs. General design features of new two-cylinder unit at Hudson Avenue station of Brooklyn Edison Co.; low-pressure exhaust design to reduce losses.

Progress. 1926. Progress in Steam Turbines. Power, vol. 65, no. 1, Jan. 4, 1927, pp. 18-22, 8 figs. Great increase in size of units; live-steam reheaters introduced; small turbines improved; wide use of bleeding and high-back pressure turbines to combine power heating and process; condensers of improved design and less surface.

Progress in. Progress in Economy of Turbine Machinery on Land and Sea, C. A. Parsons and R. J. Walker and S. S. Cook. Engineer, vol. 143, no. 3706, Jan. 21, 1927, pp. 69-71, 3 figs. Abstract of paper presented before North-East Coast Instn. of Engrs. and Shipbldrs. See also editorial comments, pp. 77-78.

STEEL

Austenitic Structure. The Decomposition of the Austenitic Structure in Steels, R. L. Dowdell and O. E. Harder. Am. Soc. Steel Treating—Trans., vol. 11, no. 2, Feb. 1927, pp. 217-232 and 338, 31 figs. Decomposition of austenite during quenching; study is made under two headings: (1) ordinary quenching conditions and (2) special consideration of high stresses produced during quenching.

Boiler. Basic Steel. Metallurgist (Supp. to Engineer, vol. 142, no. 3703), Dec. 31, 1926, pp. 178-179. Discusses problem of cracking in boiler plates; points out that basic steel has been much more widely used in Germany and America than in England; unsound steel, by whatever process it is produced, is highly undesirable for boiler-plate purposes; while basic steel is more usually produced by "rimming" variety, this can scarcely be inherent defect of basic process, but must be regarded as result of particular type of practice.

Bolt. Investigation of Bolt Steels, V. T. Malcolm and J. Juppenlatz. Am. Soc. Steel Treating—Trans., vol. 11, no. 2, Feb. 1927, pp. 177-216 and 299, 40 figs.

Brittleness. On the Impact Test of Steels at Low Temperatures, R. Yamada. Tôhoku Imperial Univ.—Sci. Reports, vol. 15, no. 5, Nov. 1926, pp. 631-659, 22 figs.

Carburized vs. Cast. Wear Resistance of Carburized Steel vs. Cast High Manganese Steel, W. J. Merten. Am. Soc. Steel Treating—Trans., vol. 11, no. 2, Feb. 1927, pp. 233-244, 7 figs.

Constitution. The Constitution of Steel and Cast Iron, F. T. Sisco. Am. Soc. Steel Treating, vol. 11, no. 1, Jan. 1927, pp. 115-128, 9 figs. Effect of various elements other than carbon added to or present as impurities in normal carbon steels; these elements found in practically all carbon steels are manganese, silicon, sulphur and phosphorus.

Corrosion. Effect of Velocity on Corrosion of Steel Under Water, R. P. Russell, E. L. Chappell and A. White. Indus. & Eng. Chem., vol. 19, no. 1, Jan. 1927, pp. 65-68, 5 figs.

Corrosion by Lubricating Oils. The Corrosion of Steel by Lubricating Oils Containing Small Amounts of Moisture and Alkalies, W. Singleton. Indus. Chemist, vol. 11, no. 23, Dec. 1926, pp. 540-549, 36 figs. Investigation by author of corrosion produced by high-grade lubricating oils upon steel, particularly in presence of small amounts of alkali salts; such conditions are liable to arise in connection with operation of steam turbines.

Die. Selection of Die Steel (Einge Richtlinien für die geeignete Auswahl von Gesenkstahl), W. Oertel. Maschinenbau, vol. 5, no. 19, Oct. 7, 1926, pp. 878-880, 4 figs. From tests it appears that tungsten steels and high-chromium steels offer best combination of properties; 0.6 to 0.7 per cent carbon steel with 0.6 to 8 per cent Mn has been used but meets requirements only for not very severe conditions.

Fatigue. The Variation in the Fatigue Strength of Metals When Tested in the Presence of Different Liquids, G. D. Lehmann. Engineering, vol. 122, no. 3181, Dec. 31, 1926, pp. 807-809, 7 figs.

Non-Metallic Inclusions. Identifying Non-metallic Inclusions in Iron and Steel, W. Campbell and G. F. Comstock. Foundry, vol. 55, no. 1, Jan. 1, 1927, supp. plate. Foundry data sheet. Determination of inclusions in steel.

Normal and Abnormal. Progress in Study of Normal and Abnormal Steel, S. Epstein and H. S. Rowdon. Am. Soc. for Steel Treating—Preprint, no. 6, for mtg. Jan. 20-21, 1927, 41 pp., 21 figs.

Normality. Normality of Steel, J. D. Gat. Am. Soc. for Steel Treating—Preprint, no. 7, for mtg. Jan. 20-21, 1927, 43 pp., 28 figs. After conducting experiments to demonstrate behaviour of steels having different grain size and amounts of segregated cementite, author dwells on properties of "cementitic lining" present in abnormal steels, arriving at conclusions that resistance to uniform hardening is caused by high oxygen content forming eutectoid alloy with constituents of austenite.

Phosphorus and Arsenic in. Phosphorus and Arsenic in Steel and the Substitution Theory, A. E. Cameron. Can. Min. & Met. Bul., no. 177, Jan. 1927, pp. 88-98, 4 figs. Interesting points brought out in comparing relative effects of arsenic and of phosphorus in steel upon physical properties. Bibliography.

Properties. Effect of Gas on Properties of Steel (Influence des gaz sur les propriétés des aciers), L. Guillet and A. Roux. Académie des Sciences—Comptes Rendus, vol. 183, no. 18, Nov. 3, 1926, pp. 717-719. Compares mechanical properties of steels after annealing in air and in vacuum; shows among other things that steel annealed in vacuum has finer crystalline structure than if annealed in air.

Reinforced Concrete vs. Why I Prefer Steel to Reinforced Concrete, G. F. Swain. Boston Soc. Civ. Engrs.—Jl., vol. 14, no. 1, Jan. 1927, pp. 1-30 and (discussion) 31-66. Author compares reinforced concrete with steel and iron, and gives reasons for his conviction that reinforced concrete has been and is being very much over-advertised, over-praised and over-boomed, with result that it has been and is being used in many cases where steel is decidedly preferable. Paper presented to Am. Inst. Steel Constr.

Solidification. Solidification of Steel in the Ingot Mould, A. L. Field. Am. Soc. of Steel Treating—Trans., vol. 11, no. 2, Feb. 1927, pp. 264-275 and (discussion) 276 and 338, 1 fig.

STEEL CASTINGS

Capacity and Production. High Capacity in Steel Castings. Iron Age, vol. 119, no. 1, Jan. 6, 1927, pp. 72-73, 6 figs. Presents tables showing capacity, 1925 production and percentage of capacity represented by production for five leading types of casting plants; acid open-hearth, basic open-hearth, electric, converter and crucible; six diagrams show history of production of steel castings over past quarter-century; specific classes of castings.

STEEL, HEAT TREATMENT OF

Carbonizing. Comparative Carbonizing Costs. Gas Age-Rec., vol. 59, no. 1, Jan. 1, 1927, pp. 21-22. Gas-fired rotary carbonizing machines vs. oil-fired oven-type semi-muffle furnaces.

Metallography and. Heat Treatment and Metallography of Steel—A Practical Course in the Elements of Physical Metallurgy, H. C. Knerr. Forging—Stamping—Heat Treating, vol. 12, nos. 1, 2, 3, 4, 6, 8, 9, 10, 11 and 12, Jan., Feb., Mar., Apr., June, Aug., Sept., Oct., Nov. and Dec. 1926, pp. 9-14, 52-56, 99-104, 127-131, 212-219, 275-279 and 283, 339-343, 392-397, 428-432 and 451-455, 74 figs. Jan.: Carburizing and case-hardening. Feb.: Effects of alloying elements. Mar. and Apr.: Special alloying elements. June: Chromium-vanadium and nickel-chromium steels. Aug.: Manganese. Sept.: Silicon and molybdenum. Oct.: High-speed steel, composition, metallography and theory of hardening; heat treatment. Nov.: Equipment used in heat treatment. Dec.: Furnaces for heat treatment.

Oil-Hardening Steel. Heat-Treatment of Oil-Hardening Steel, A. Mumper. Forging—Stamping—Heat Treating, vol. 13, no. 1, Jan. 1927, pp. 9-11, 5 figs. Deals with heat treatment of oil-hardening tool steel for blanking and stamping dies.

Tempering. Tempering Plain Carbon Tool Steels, V. E. Hillman. Forging—Stamping—Heat Treating, vol. 12, no. 12, Dec. 1926, pp. 444-446 and 450, 3 figs. Results of investigation into effect of prolonged heating in tempering plain carbon steels; drawing mediums and furnace tempering.

STELLITE

Welding, Application to. Stelliting: A New Welding Process, A. V. Harris. Mech. Eng., vol. 49, no. 2, Feb. 1927, p. 123. "Stelliting" is neither welding nor brazing in ordinary sense of words; it calls for blowpipe flame which contains fairly large excess of acetylene to lower flame heat and to exclude as much atmospheric oxygen as possible; surface of base metal to which stellite is to be applied is brought up to such a heat that it just begins to sweat and assume oily appearance.

STEEL MANUFACTURE

Research. Fundamental Research in Steel Manufacture, C. H. Herty, Jr. Am. Soc. for Steel Treating—Preprint, no. 5, for mtg. Jan. 20-21, 1927, 14 pp., 5 figs. Classifies problems encountered in making of steel and points out that field for fundamental research in its manufacture is astounding in its magnitude and intricacies; consideration of fundamental research which deals primarily with slag-metal reactions giving particular attention to formation and elimination of non-metallic inclusions formed from manganese, silicon and aluminum.

STREAM POLLUTION

Effects of. Stream Pollution and Its Effects, N. T. Veatch, Jr. Am. Water Works Assn.—Jl., vol. 17, no. 1, Jan. 1927, pp. 58-64. Solution of problem calls for (1) treatment of sewage and trade wastes at their source; (2) maintenance and careful operation of sewerage systems and disposal plants; (3) purification of water at intakes of water supplies to extent necessary for safety; and (4) careful operation of water purification plants.

STRESSES

Spoked Wheels. On the Stresses in a Spoked Wheel Under Loads Applied to the Rim, A. J. S. Pippard and J. F. Baker. Lond., Edinburgh & Dublin Philosophical Mag., vol. 2, no. 12, Dec. 1926, pp. 1234-1253, 5 figs. Analysis of stress in wheel when it is held rigidly at hub and subjected to any system of loads applied to rim; problem is reduced to analysis of stresses under tangential and radial load, and these cases are considered separately.

STRUCTURAL STEEL

Advantages. The Merits and Advantages of Steel, B. Stoughton. Can. Machy., vol. 37, no. 1, Jan. 6, 1927, pp. 23-27. Properties and manufacture of steel; compared with other kinds of structural materials, it is homogeneous and the only simple and ductile material; pliability of steel; steel vs. concrete. (Abstract.) Address before Am. Inst. of Steel Construction.

High-Silicon. High-Silicon Structural Steel, H. W. Gillett. U.S. Bur. of Standards—Technologic Papers, no. 331, Nov. 1, 1926, pp. 121-143, 10 figs. German steel, known as "Freund" steel, has aroused interest of structural engineers; test results on specimens submitted to Bureau of Standards, showing steel to combine desirable properties of high yield point and high ductility; it is unusually high in silicon, containing about 1 per cent, and low in carbon, containing less than 0.15 per cent; recent American practice in manufacture of high yield-point structural steel has tended toward use of manganese as alloying element; from sole basis of cost of alloying element silicon should be nearly as cheap as, and sometimes cheaper than, manganese and considerably cheaper than nickel; hence, attention of American steel makers is called to possibilities of its use; summary of published data on alloying effect of silicon and manganese; presents evidence which leads to conclusion, contrary to some German claims, that no special type of furnace is required for manufacture of silicon steel.

SUBSTATIONS

Automatic. Automatic Substations for Industrial Plants, E. L. Hough. Power Plant Eng., vol. 31, no. 4, Feb. 15, 1927, pp. 250-252, 5 figs. Reduction in attendance charges and elimination of inefficient operator hazard are only two of several advantages of automatic equipment.

Outdoor. New Hochelaga Substation for M. L. H. & P. Co. Elec. News, vol. 36, no. 3, Feb. 1, 1927, pp. 42-43, 4 figs. Three 66,000/12,000-volt, 15,000-kva., single-phase transformers mounted outdoors; unusual features in construction.

Standard. Standardizing Distribution Substations, E. F. Pearson and T. Perry. Elec. World, vol. 89, no. 4, Jan. 22, 1927, pp. 189-190, 4 figs. Systematic distribution planning leads to adoption of standard substations; ultimate capacity of each established at 6,000-kva. to 3,000-kva. units to constitute initial installation; costs given for each type.

SUPERPOWER

Plant Location and. Superpower, What It Means to Manufacturing Costs, W. S. Murray. Factory, vol. 38, no. 2, Feb. 1927, pp. 266-269, 3 figs. Points out that power is magnet which attracts industries to centralized locations; superpower is making new locations available for industrial development; high-potential transmission lines across country are forerunners of factories.

T

TAPPING MACHINES

Automatic. Gisco Automatic Tapping Machine. Am. Mach., vol. 66, no. 5, Feb. 3, 1927, pp. 229-230, 1 fig. Operation is fully automatic, tap being fed into work to predetermined point, reversed and back to starting point when its direction of rotation is again reversed and tap fed down.

TELEPHOTOGRAPHY

Radio. Radio Photography and Television, E. F. W. Alexanderson. Gen. Elec. Rev., vol. 30, no. 2, Jan. 1927, pp. 78-84, 11 figs. Consideration of transmission by continuous waves and interrupted waves; multi-shade process; television problem; higher speed and more brilliant receiving projectors needed; prospects of development based on present attainments.

TERMINALS, MARINE

Improvement. The Economics of Terminal Improvement, L. E. Dale. World Ports, vol. 15, no. 4, Feb. 1927, pp. 483-495 and (discussion) pp. 495-504. Methods of originating, terminating and distributing freight; nature of present operations; freight which must cross river; costs of pier-station handling; adequacy of pier-station facilities; present lighterage operations; interchange floating between terminals; terminals on Jersey shore.

TIMBER

Acids, Effect of. The Effect of Acids on the Mechanical Strength of Timber, E. A. Alliott. Chem. & Industry, vol. 45, no. 53, Dec. 31, 1926, pp. 463T-466T, 8 figs. Results of tests carried out to gain more precise information as to general effect of various acids on wood filter press plates and frames.

TRACTORS

Caterpillar. Caterpillar Tractors, W. A. Capron. Army Ordnance, vol. 7, no. 4, Jan.-Feb. 1927, pp. 273-279, 11 figs. Methods and equipment of Caterpillar Tractor Co. having its main plant at San Leandro, Cal., with factory branch in Peoria, Ill.

TRANSFORMERS

Fundamentals. Transformer Fundamentals, E. G. Reed. Elec. Jl., vol. 24, no. 1, Jan. 1927, pp. 30-32, 4 figs. Operation without secondary load; expression for alternating electromotive force and current; fundamental transformer equation; operating with secondary load.

Static. Notes on Static Transformer Testing and Test Plant Requirements, L. Smith. Junior Instn. Engrs., vol. 37, Dec. 1926, pp. 116-135, 9 figs. Outlines ratio, loss and pressure tests on static transformer, and considers means adopted to demonstrate that thermal conditions on continuous full load meet guaranteed figure.

TUNGSTEN

Developments. Tungsten and Chromium, C. H. Smithells. Metal Industry (Lond.), vol. 30, no. 1, Jan. 7, 1927, pp. 31-32, 1 fig. Deals with latest developments, chromium, apart from its uses as an alloy in heat-resisting materials, is coming more and more into favour for electroplating.

TURBO-GENERATORS

Small. Some Small Turbines of Unique Design, J. A. MacMurchy. Power Plant Eng., vol. 31, no. 3, Feb. 1, 1927, pp. 198-200, 3 figs. Turbine generator sets recently developed have turbine rotor overhung on pinion shaft of reduction gear.

160,000-Kw. The 160,000-Kilowatt Turbine-Generator for Hell Gate. Power, vol. 65, no. 6, Feb. 8, 1927, pp. 226-227, 3 figs. Unit was designed to provide maximum attainable capacity in available space. Abstracted from article in Brown Boveri Rev., Jan. 1927.

V

VACUUM TUBES

Filamentless. Filamentless Valves for A.C. Supply. Wireless World, vol. 20, no. 4, Jan. 26, 1927, pp. 115-116, 3 figs. Introduction of indirectly-heated cathode to eliminate filament battery.

VAPOURS

Pressure Measurement. An Improved Dynamic Method for Measuring Vapour Pressures, J. N. Pearce and R. D. Snow. Jl. Phys. Chem., vol. 31, no. 2, Feb. 1927, pp. 231-245, 3 figs.

VIBRATION

Continuous Motion Produced by. Continuous Motion Produced by Vibration, W. B. Morton and A. McKinstry. Phys. Rev., vol. 29, no. 1, Jan. 1927, pp. 192-196, 2 figs.

VOLTAGE REGULATION

Regulators. Automatic Regulators Control Voltage Over Wide Ranges, W. H. Turner. Power, vol. 65, no. 5, Feb. 1, 1927, pp. 164-166, 4 figs. Describes operation of broad-range regulators and tells how to put machines into service where they are used.

W

WAGES

Incentives. High Productivity and Incentive Wage Payment Go Together. Mfg. Industries, vol. 13, no. 1, Jan. 1927, pp. 35-36.

Overtime Will Defeat Purpose of Incentive Wage Plans, L. A. Sylvester. Mfg. Industries, vol. 13, no. 1, Jan. 1927, pp. 31-35, 6 figs.

WASTE ELIMINATION

Industrial. The War on Waste, F. P. Poole. Soc. Indus. Engrs.—Bul., vol. 9, no. 1, Jan. 1927, pp. 17-22. Brief statement of waste situation in several different fields; discusses important factors in waste elimination. Paper read before joint meeting of Am. Soc. Mech. Engrs. and Engrs'. & Architects' Club at Louisville, Ky.

WATER

Analysis. Report of Committee No. 1 on Standard Methods of Water Analysis. Am. Water Works Assn.—Jl., vol. 17, no. 1, Jan. 1927, pp. 112-126. Non-confirming spore formers and their significance in water examinations; determination of turbidity and coefficient of settling; determination of dissolved oxygen and free chlorine, free CO_2, etc.

WATER TREATMENT

Hydraulic Jump, Use of. The Hydraulic Jump as a Mixing Device, A. G. Levy and J. W. Ellms. Am. Water Works Assn.—Jl., vol. 17, no. 1, Jan. 1927, pp. 1-23 and (discussion) 24-26, 8 figs. Results of experiments to study action of jump from standpoint of method for chemical mixing and to investigate on sufficiently large scale its practicability for conditions required in good filtration-plant design; it was concluded that hydraulic jump is extremely effective means for mixing chemicals with water to be purified; mixing effect is produced with great rapidity and with remarkable thoroughness; structure in which jump may be produced is simple.

Small Town Plants. Highly Efficient Water Purification Plants for Town of Less Than 2,000. Contract Rec., vol. 41, no. 5, Feb. 2, 1927, pp. 100-103, 2 figs. Experimental studies to determine limits of raw-water pollution which are consistent with production of effluents conforming to accepted standards of bacterial quality.

Turbidity Reduction. Coagulant Being Used to Reduce Turbidity in New York Water, W. W. Brush. Eng. News-Rec., vol. 98, no. 3, Jan. 20, 1927, p. 112. High turbidities in supply reservoirs caused by floods in late fall; satisfactorily reduced by alum treatment.

WATER WORKS

Rate of Return. The Rate of Fair Return for Water Works, H. P. Gillette and A. S. Malcomson. Water Works, vol. 66, no. 2, Feb. 1927, pp. 52-54, 4 figs. Results of comprehensive study. Paper presented at Pennsylvania Water Works Assn.

WATTMETERS

Calculation. Wattmeter Calculations, M. C. Schroggie. Elec. Rev., vol. 99, no. 2562, Dec. 31, 1926, pp. 1064-1065, 6 figs. Correction of power-loss errors.

WELDING

Cast Aluminum. How to Weld Cast Aluminum. Diesel Oil Engine Jl., vol. 2, no. 6, Jan. 1927, pp. 39-41, 8 figs. Methods which have been successfully used in repair shops and foundries.

Electric. *See Electric Welding, Arc; Electric Welding, Resistance.*

English Practice. English Welding Practice, P. L. Roberts. Welding Engr., vol. 12, no. 1, Jan. 1927, pp. 32-33. Publicity methods have gained wider adoption of welding in America than in England; applications of processes compared.

Filler Rods. Properties of Steel Filler Rods for Welding. Boiler Maker, vol. 27, no. 1, Jan. 1927, pp. 19-20. General significance of chemical analysis; flux coatings; cast-iron and alloy filler rods.

Oxy-Acetylene. *See Oxy-Acetylene Welding*

Power Plants. Special Uses of Welding in Westport Station. Power, vol. 65, no. 7, Feb. 15, 1927, pp. 249-250, 5 figs. Welding used for variety of purposes, including pipe-line fabrication, replacement of studs in boiler handhole plates, repair of broken stoker cranks and removal of generator rotor end rings.

Progress in. Recent Progress in the Welding Field, R. E. Smythies. Can. Machy., vol. 37, no. 3, Jan. 20, 1927, pp. 22-26, 5 figs. Outlines progress made in both structural steel and machinery fields. Paper read before Eng. Inst. of Canada.

WIND TUNNELS

Standardization Tests. Wind Tunnel Standardization Disk Drag, M. Knight. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 253, Dec. 1926, 6 pp., 3 figs. Deals with resistances of series of three similar disks placed normal to wind as determined in atmospheric wind tunnel of Nat. Advisory Committee for Aeronautics.

Tests. Method of Correcting Wind Tunnel Data for Omitted Parts of Airplane Models, R. H. Smith. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 254, Jan. 1927, 10 pp., 1 fig.

WIRE

Copper, Conductivity. Notes on the Relation of Annealing Temperature to Conductivity of Copper Wire, J. C. Bradley. Am. Inst. Min. & Met. Engrs.—Trans., Feb. 1927, 2 pp., 1 fig. Conductivity hard was 98.26 per cent; after a 10-min. heating at 200 deg. cent. it was 98.69; by annealing 10 min. at 300 deg. large increase to 100.93 occurred; maximum conductivity, 101.15, was attained after 500 deg. anneal; thereafter it decreased to 100.53 after 950 deg. anneal; if copper is gassed decrease is much more than this.

Z

ZINC

Production and Refining. The Production and Refining of Remelted Zinc, E. R. Thews. Metal Industry (N.Y.), vol. 25, no. 2, Feb. 1927, pp. 60-62, 3 figs. Modern practice in producing good zinc from scrap.

ZINC METALLURGY

Electrolytic Production. Electrolytic Zinc, W. E. Harris. Indus. Chemist, vol. 3, no. 24, Jan. 1927, pp. 27-31, 3 figs. Roasting or calcination; leaching; purification of crude zinc liquors; electrolysis of solution.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

AIR COMPRESSORS

Diesel Engines. Modern Air Compressor Practice in Oil Engine Installations, R. L. Quertier. Diesel Engine Users' Assn.—Report of Discussion, no. S75. Deals with air compressor as driven by main Diesel engine to supply necessary air for atomizing fuel and charging starting bottles and with auxiliary compressors for charging purposes, etc.

AIRCRAFT

Landing and Stopping Mechanisms. Aircraft Alighting and Arresting Mechanisms. Instn. Aeronautical Engrs.—Jl., vol. 1, no. 2, Feb. 1927, pp. 29-47 and (discussion) 47-55, 15 figs. Design of aircraft arresters; particulars of compression rubbers.

AIRCRAFT CONSTRUCTION MATERIALS

Dopes. Cellulose Acetates for Aero Dopes, H. T. S. Britton. Indus. Chemist, vol. 3, no. 25, Feb. 1927, pp. 59-61, 1 fig. Deals chiefly with acetylene cellulose coverings, with brief reference to those of nitro-cellulose.

AIRPLANE ENGINES

Installation. Aircraft Power Plant Installations, H. M. Mullinnix. Am. Soc. Naval Engrs.—Jl., vol. 39, no. 1, Feb. 1927, pp. 68-75. Deals with installation or suspension of engine in structure of airplane.

Tests. Description of the N.A.C.A. Universal Test Engine and Some Test Results, M. Ware. Nat. Advisory Committee for Aeronautics—Report, no. 250, 1927, 15 pp., 11 figs. Describes 5-in. bore by 7-in. stroke single-cylinder test engine used at Langley Field laboratory, and results of tests made therewith; data have been obtained which indicate effect of changes of compression ratio on friction horsepower and volumetric efficiency.

AIRPLANES

Airfoils. Pressure Distribution Over Airfoils at High Speeds, L. J. Briggs and H. L. Dryden. Nat. Advisory Committee for Aeronautics—Report, no. 255, 1927, 42 pp., 17 figs. Extension of investigation of aerodynamic characteristics of certain airfoils; results presented in Report No. 207 have been confirmed and extended to higher speeds through more extensive and systematic series of tests: tests were made on models of 1-in. chord.

Controls. Aeroplane Controls: Faults and Diagnosis, W. G. Gibson. Roy. Aeronautical Soc.—Jl., vol. 31, no. 195, Mar. 1927, pp. 237-243. Deals with functioning, maintenance and adjustment of flying controls.

Mechanical Resistance. Permanent Commission of Aeronautical Studies Report No. 4. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 402, Mar. 1927, 19 pp. Conclusions approved by subcommittees on determination of mechanical resistance to airplanes, includes (1) determination of main conditions entailing overload and examination of existing theoretical and experimental data; (2) reduction of general conditions of calculation to some simple cases; (3) determination of load factors to be adopted in each of these cases; (4) methods of control, known as static tests. Supp. to Bul. de la Chambre Syndicale des Industries Aéronautiques.

AIRSHIPS

Terminals. Airship Terminals. Aviation, vol. 22, no. 11, Mar. 14, 1927, pp. 527-528, 1 fig. Mast is highly satisfactory method of mooring commercial airships; prevention of pitching one of the problems to be solved; taking-on and releasing airplanes from airships in flight.

ALCOHOL

Ethyl. Ethyl Alcohol from Cellulose (L'Alcool éthylique de cellulose), G. Meunier. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 369-371. Describes plant treating 10 tons in 24 hours of cellulose material; economic considerations.

See also Methanol.

ALLOY STEELS

Electrotechnical. Special Steels (Les aciers spéciaux), M. R. Jouaust. Société Française des Electriciens—Bul., vol. 6, no. 62, Oct. 1926, pp. 1175-1182. Discusses magnetic substances of high initial permeability and small total losses, particularly with reference to their use in long-distance telephone lines; magnetic data are given for iron-duct cores made by Western Electric Co., and mode of preparation of these cores, which may advantageously be used for Pupin coils; composition of perm-alloy; alloy, with its high permeability in weak fields, small hysteresis losses and high resistivity, is particularly suitable for use in Krarup process, thin ribbon of this material being wound round cable; permax, a nickel-steel alloy; account of cobalt steels of high coercive force, such as KS alloy of Honda, for making permanent magnets.

ALLOYS

Aluminum. *See Aluminum Alloys.*
Bearing Metals. *See Bearing Metals.*
Brass. *See Brass.*
Copper. *See Copper Alloys.*
Iron. *See Iron Alloys.*
Magnesium. *See Magnesium Alloys.*

ALUMINUM

Gasket Material. Aluminum as a Gasket Material, J. E. Housley. Power, vol. 65, no. 10, Mar. 8. 1927, p. 374. Aluminum gaskets have been used for many purposes about oil refineries for number of years owing to resistance to corrosion and oxidation by oil compounds at high temperatures and pressures.

Soldering and Welding. Some Practical Notes on Soldering and Welding Aluminum, A. Eyles. Engineer, vol. 143, no. 3708, Feb. 4, 1927, pp. 121-123, 5 figs. It is shown that aluminum can be welded, but it is not advisable to employ soldering methods, strictly speaking, for assembly of structures; its only actual feasible applications are for repairing fractured or broken parts, and for filling up surface holes and slight defects in castings; it can also be applied on stressed members or on any components, failure of which might be serious; two distinct methods used in welding aluminum are puddling and flux systems; preparation of metal for welding and execution of welds in aluminum.

ALUMINUM ALLOYS

Deformation. Deformation of an Aluminum Alloy by a Constant Load, C. B. Sadtler and J. L. Gregg. Am. Inst. Min. & Met. Engrs.—Trans., no. 1645-E, Mar. 1927, 6 pp., 4 figs. Deals with variations of deformation produced by constant tensile stress acting for varied lengths of time in special case of thin aluminum alloy sheet of duralumin type, which has been subjected to different thermal and mechanical treatments.

Duralumin. *See Duralumin.*

Lautal. The Wrought Light Alloy "Lautal." Engineering, vol. 123, no. 3186, Feb. 4, 1927, p. 133. This alloy, which has recently come into prominence, possesses property of age hardening, but does not age automatically at room temperatures.

AMMONIA COMPRESSORS

Power Consumption. Power Consumption of Ammonia Compressors, W. H. Motz. Power, vol. 65, no. 11, Mar. 15, 1927, pp. 409-410, 2 figs. Theoretical power requirements; actual indicated horse power; input horse power; horse power charts.

Sleeve-Valve. The High-Speed Compressor, E. Prestage. Ice & Cold Storage, vol. 30, no. 348, Mar. 1927, pp. 65-70 and (discussion) 75-76, 7 figs. Consideration of sleeve valve as presenting ideal solution of high-speed problem.

The Sleeve-Valve in Refrigerating Practice, E. Prestage. Cold Storage, vol. 30, no. 347, Feb. 17, 1927, pp. 52-55, 11 figs. High-speed compressor problems and their solution.

AUTOMOBILE ENGINES

Combustion. Studies of Combustion in the Gasoline Engine, W. G. Lovell and J. D. Coleman, with T. A. Boyd. Indus. & Eng. Chem., vol. 19, no. 3, Mar. 1927, pp. 373-378, 10 figs. Determination of rate of burning by chemical analysis; burning of hydrogen and carbon monoxide.

Fuels. *See Automotive Fuels.*

Heavy-Oil. Adaptation of Gasoline Engines to Use of Heavy Oils (L'adaptation des moteurs à essence aux huiles lourdes), P. Dufour. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 380-382. Mixture of oil and gasoline; direct carburetion of oil; process of preliminary evaporation; super-Diesel engines; in author's opinion, it is possible to develop light engine of high speed, to operate with heavy oils.

High-Speed Oil Engines for Vehicles, L. Hausfelder. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 397, Feb. 1927, 32 pp., 10 figs. Deals with engines with external and internal atomization of fuel, hot-bulb and Diesel engines. Translated from Motorwagen, Aug. 31, 1926.

AUTOMOBILES

Brake Linings. Some Factors That Affect the Frictional Properties of Automobile Brake-Linings, H. H. Allen. Soc. Automotive Engrs.—Jl., vol. 20, no. 1, Jan. 1927, pp. 77-85, 13 figs. Laboratory tests have been paralleled by series of experiments undertaken with view to securing data on working conditions of brakes of automobile in actual service.

Brakes. Brakes for Automotive Use, J. Wiggers. Soc. Automotive Engrs.—Jl., vol. 20, no. 1, Jan. 1927, pp. 141-145 and (discussion) 145-147, 12 figs.

Design. Trends in Passenger-Car Design. Soc. Automotive Engrs.—Jl., vol. 20, no. 2, Feb. 1927, pp. 195-196 and 254. Tendencies evidenced at recent national automobile shows analyzed.

Transmission. A Four-Speed Internal-Underdrive Transmission, C. A. Neracher and H. Nutt. Soc. Automotive Engrs.—Jl., vol. 20, no. 2, Feb. 1927, pp. 247-254, 12 figs. Reasons for failure of present four-speed transmissions to give satisfaction are cited, and stress is laid on need of reducing maximum engine speed while at same time maintaining or improving over-all car ability; describes four-speed transmission by which gasoline consumption, as indicated by road tests, is said to show saving of approximately 20 per cent.

AUTOMOTIVE FUELS

ANTI-KNOCK. Combustible Liquids of High Organic Sulphur Content as a Source of Anti-Detonators (Utilisation des combustible liquides à teneur élevée en composés sulfo-organiques, comme source de combustible antidétonant), Y. Altchidjian. Académie des Sciences—Comptes Rendus, vol. 183, no. 21, Nov. 22, 1926, pp. 975-978. See brief translated abstract in Chem. & Industry, vol. 46, no. 3. Jan. 21, 1927, p. 34.

The Vapor-Phase of the Anti-Knock Problem, W. G. Leamon. Soc. Automotive Engrs.—Jl., vol. 20, no. 1, Jan. 1927, pp. 67-76, 13 figs.

Theory That Non-Conductivity Causes Knock Not Borne Out by Known Facts. G. G. Brown. Nat. Petroleum News, vol. 19, no. 6, Feb. 9, 1927, pp. 88-94. Reply to article by H. Grote published in Dec. 29, 1926, issue of same journal, under title "Gasin, a new working substance for internal-combustion motors."

COAL, GASOLINE SUBSTITUTES FROM. Production of Gasoline Substitutes from Coal, A. C. Fieldner. Soc. Automotive Engrs.—Jl., vol. 20, no. 1, Jan. 1927, pp. 98-103, 5 figs. and (discussion) 103-104. Presents general review of situation and status of research in manufacture of gasoline substitutes from coal of which enormous quantities remain unmined in United States.

DOPES AND DETONATION. Dopes and Detonation, H. L. Callendar. Engineering, vol. 123, nos. 3186, 3187 and 3188, Feb. 4, 11 and 18, 1927, pp. 147-148, 182-184 and 210-212, 7 figs. Results of experiments made in Air Ministry Laboratory at Imperial College of Science, London. Effect of peroxides in nuclear drops; effect of mixture strength on temperature of initial combustion; engine speed and activation of mixture; aldehydes and detonation.

IMPROVEMENT. Problems of Automobile Engines and Substitute Fuels (Le stade actuel des problèmes du moteur d'automobile et des carburants de remplacement), A. Grebel. Génie Civil, vol. 89, nos. 23, 24 and 25, Dec. 4, 11 and 18, 1926, pp. 499-502, 532-534 and 552-556. Points out that thermodynamic quality of motor fuels can and should be improved; manufacture of fuels by direct hydrogenation of coal, according to Bergius process; manufacture of volatile fuels by cracking; catalysts and hydrogenation of natural or prepared liquid fuels, and direct utilization of these fuels in engines.

MAKHONINE CARBURANT. The Makhonine Carburant. Petroleum Times, vol. 17, no. 424, Feb. 26, 1927, pp. 385-386. Includes translation of inventor's communication in which he states that carburant is at present obtained from coal tars, heavy oils de-benzoled, so that it is possible to transform about 90 per cent; essential merit of product obtained is that it is non-inflammable at ordinary temperatures and pressures, stable and non-volatile; use of this carburant in exploitation will not be possible until maker can give guarantee for constituency of composition quite as reliable as those exacted at present for various qualities of motor spirit used for airplanes.

STARTING PROPERTIES. A Laboratory Method of Determining the Starting Properties of Motor Fuels, W. G. Lovell and J. F. Coleman, with T. A. Boyd. Indus. & Eng. Chem., vol. 19, no. 3, Mar. 1927, pp. 389-394, 10 figs. Method consists in measuring directly air-fuel ratio necessary to produce explosive mixture at any given temperature.

TESTING. Apparatus and Method for Rating Motor Fuels in the Order of Detonation, W. F. Faragher and W. H. Hubner. Soc. Automotive Engrs.—Jl., vol. 20, no. 3, Mar. 1927, pp. 405-408, 3 figs. Describes apparatus and method of operating it in determining rating of motor fuels in order of their detonation; results obtained in experiments are presented graphically.

B

BALANCING MACHINES

STATIC. Static Balancing Machine. Iron Age, vol. 119, no. 11, Mar. 17, 1927, p. 789, 3 figs. Simple operation features unit for production balancing of narrow-faced parts, placed on market by Gisholt Machine Co., Madison, Wis.

BEARING METALS

CALCULATING METAL QUANTITIES. Calculating Metal Quantities for Alloys, A. W. Beshgetoor. Am. Mach., vol. 66, no. 8, Feb. 24, 1927, p. 331, 1 fig. Method suitable for calculating bearing-metal alloys to any desired composition.

BEARINGS, ROLLER

RAILWAY. Anti-Friction Bearings for Heavy Duty on Railway Rolling Stock. Ry. & Locomotive Eng., vol. 40, no. 2, Feb. 1927, pp. 38-41, 4 figs. Application of roller bearings to Bethlehem auxiliary locomotive.

BLAST FURNACES

PRODUCER GAS. Partial or Total Replacement of Metallurgical Coke by Producer Gas in Blast Furnaces (Du remplacement partiel ou total dans les hauts fourneaux du coke métallurgique par du gas de gazogène), R. D. Lance. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 399-405. Shows that use of producer gas permits elimination in charge of at least 70 per cent of coke, which can be replaced by cheaper fuels; proposed system require 2 rows of tuyeres, about 1 m. apart, 2 sets of recuperators and one or more producers burning coal or lignite.

SPECIFIC EFFICIENCY. Specific Efficiency of the Blast Furnace, R. Franchot. Am. Inst. Min. & Met. Engrs.—Trans., no. 1596-C, Sept. 1926, 18 pp., 1 fig.

BOILER FEEDWATER

FOAMING AND PRIMING. Present Knowledge of Foaming and Priming of Boiler Water, with Suggestions for Research. C. W. Foulk. Am. Water Works Assn.—Jl., vol. 17, no. 2, Feb. 1927, pp. 160-173. Progress report of Subcommittee No. 3 on zeolitic softeners, internal treatment, priming and foaming and electrolytic scale prevention.

TREATMENT. Boiler Scale and Its Prevention (Sur un cas d'incrustation des chaudières alimentées avec de l'eau épurée et le moyen de l'éviter), P. LeTellier and H. Sunder. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 241-242. Describes process of treating feedwater by replacing adequate quantity of sodium phosphate by phosphoric acid.

Pretreatment of Boiler Feedwater, C. R. Knowles. Am. Water Works Assn.—Jl., vol. 17, no. 2, Feb. 1927, pp. 151-159. Progress report of Subcommittee No. 2 on water softening by chemicals (external treatment); operationg of continuous and intermittent lime-soda water-softening plants; economic value of lime-soda softening preliminary to zeolite softeners and to evaporators.

TRI-SODIUM PHOSPHATE. Overcoming Boiler-Water Troubles with Tri-Sodium Phosphate, B. C. Sprague. Power, vol. 65, no. 9, Mar. 1, 1927, pp. 321-322, 1 fig. Sulphate waters will not cause adherent scale if enough sodium carbonate is added to maintain certain ratio between carbonate and sulphate in boiler water; at high operating pressures, however, most sodium carbonate decomposes into sodium hydroxide, making it difficult to maintain desired ratio; this difficulty can be avoided by use of tri-sodium phosphate.

BOILER FURNACES

HEATING SURFACE. Effect of Direct Heating Surface on Efficiency, J. G. Coutant. Combustion, vol. 16, no. 2, Feb. 1927, pp. 99-100, 2 figs. Boiler furnaces should be designed to obtain highest initial temperature by providing necessary amount of direct heating surface in proportion to fuel burned, special attention being given to methods of combustion that give clear furnace conditions and permit greatest possible transfer of heat by radiation.

BOILER TUBES

DAMAGES. Damages to the Tubes of Small-Tube Water-Tube Boilers, J. Levai. Am. Soc. Naval Engrs.—Jl., vol. 39, no. 1, Feb. 1927, pp. 39-51, 11 figs. Results of inspection of small-tube water-tube boilers and water pipes subjected to high stresses; tubes were made according to Mannesmann-Pilger process, in which, according to specifications, they were drawn through passes while cold; type of erosions displayed is indication of fatigue of metal.

BOILERS

HEAT LOSSES. Losses of Heat Due to Dirt in Boilers (Perte de chaleur due à l'encrassement des chaudières à vapeur), Hellemans. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 300-308, 3 figs. Points out that boilers deteriorate because of scale formation inside and by soot and cinder deposits on outside; describes methods of cleaning boilers, and gives results of tests.

HIGH-PRESSURE. Boiler Operates Successfully at 1,500 Lbs. Power Plant Eng., vol. 31, no. 5, Mar. 1, 1927, pp. 300-301, 2 figs. Boiler plant furnishes steam for manufacture and heating in practically continuous operation; powdered fuel is fired direct from high-speed beater-type unit coal pulverizers.

BOILERMAKING

BOILER-DRUM PRODUCTION. The Manufacture of High-Pressure Boiler Drums. Engineer, vol. 143, no. 3712, Mar. 4, 1927, pp. 246-248, 11 figs. As alternative to forging, firm of Thyssen & Co. has developed process of making seamless drums by welding, which, it is claimed, produces equivalent results at about two-thirds the expense.

BORING MACHINES

HYDRAULIC. Baker Hydraulic Boring and Drilling Machine. Machy. (N.Y.), vol. 33, no. 7, Mar. 1927, pp. 541-542, 2 figs. No. 50H hydraulic vertical boring and drilling machine known by name of "Twin Pull."

BRAKES

AIR. Air-Brake Equipment Reconditioned by Modern Devices, F. W. Curtis. Am. Mach., vol. 66, no. 11, Mar. 17, 1926, pp. 457-459, 8 figs. Denver & Rio Grande Western R.R. Co., Denver, Colo., takes precautions in handling repair work necessary in reconditioning triple valve so that its positive operation in service will be assured; triple valve parts are reconditioned in Foster semi-automatic valve-finishing machine.

BRASS

DEFECTS. Common Defects in Brass. Metallurgist, (Supp. to Engineer), Feb. 25, 1927, pp. 29-30. Common defects encountered in brass articles made from sheet and strip may be divided into two distinct categories, those which are due to defects in metal as cast, and those which arise in course of subsequent operations; defects, such as red stains, occur during course of manufacture.

HEAT TREATMENT AND HARDNESS. A Study of the Heat Treatment, Microstructure and Hardness of 60:40 Brass, F. H. Clark. Am. Inst. Min. & Met. Engrs.—Trans., no. 1630-E, Mar. 1927, 30 pp., 91 figs. Experimental work to study effect of mechanical work on rolled 60:40 brass, quenched and reheated, and mechanism of twinning in alpha reeds of furnace-cooled specimen; it was desired to determine effect of mechanical work on transformations taking place on reheating quench material, both at 200 and 470 deg. cent.

HOT-ROLLED. Hot-Rolled Brass Bars. Soc. Mech. Engrs. (Tokyo)—Jl., vol. 30, no. 117, Jan. 1927, pp. 1-29, 55 figs. Great variation of quality of hot-rolled brass bars of same composition and of same manufacture can be detected by examining value of ultimate shearing strain or roughness of surface of test piece which it retains after testing; based on tension and torsion test and examination of inner structure of such materials, author has ascertained that this variation of quality is in accordance with temperature at which bars are presumed to have been rolled; tensile and torsional strength and measures of toughness to be obtained by tension test may fail to furnish any evidence of such variation of quality. (In Japanese.)

BRASS CASTINGS

WATER-COOLED CHILLS. Water-Cooled Chills. Eng. Progress, vol. 8, no. 2, Feb. 1927, p. 33. Points out disadvantages connected with use of thick-walled cast iron chills when casting non-ferrous metals, and employment of thin-walled chills cooled by cooling liquid, which also regulates cooling of fluid metal.

BRASS FOUNDRIES

FURNACE TYPES. Furnace Types in Brass Foundries. Brass World, vol. 23, no. 2, Feb. 1927, pp. 49-51. Important features of considerable amount of data submitted by more than 80 brass foundries; furnace types and fuels; fluxes and linings receive careful analysis and consideration.

REARRANGEMENT. Rearranging a Brass Foundry. Iron Age, vol. 119, no. 9, Mar. 3, 1927, pp. 636-637, 3 figs. Large increase in capacity from new layout, including conveying and sand-handling equipment, at 2-storey foundry of Kennedy Valve Mfg. Co., Elmira, N.Y.

BRIDGES, HIGHWAY

DESIGN. Highway Bridges, A. E. Kleinert, Jr. Boston Soc. Civ. Engrs.—Jl., vol. 14, no. 2, Feb. 1927, pp. 137-142. Desirable featúres should be kept in mind in planning new bridge; reinforced-concrete bridges for spans under 50 ft.; steel bridges for spans over 50 ft.; types of abutments; reconstruction of steel through-truss bridges; continuous bridges.

BRIDGES, RAILWAY

STEEL. Report of Committee XV—Iron and Steel Structures. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 294, Feb. 1927, pp. 715-783, 27 figs. Specifications for waterproofing and drainage of solid-floor railway bridges; tests on bearing value of large rollers; interim reports on impact and revision of bridge rules.

Steel Railway Bridges of Large Span, A. Ronsse and E. J. F. Derijckere. Int. Ry. Congress Assn.—Bul., vol. 9, no. 2, Feb. 1927, pp. 87-98; 13 figs. Design of bridge of 197-ft. span to carry five tracks, to be built across River Ourthe; Baltimore type of girder was decided upon; lines of influence giving forces in members in Baltimore girder.

BRIDGES, STEEL

RAILWAY-HIGHWAY. The Dunblane Bridge Over the South Saskatchewan River, W. Walkden. Contract Rec., vol. 41, nos. 4, 6, 7 and 9, Jan. 26, Feb. 9, 16 and Mar. 2, 1927, pp. 74-78, 122-128, 146-151 and 204-208, 32 figs. Engineering and construction features of combined railway and highway structure; type of span having roadway located between main trusses at bottom chord level, with railway deck immediately overhead at elevation, in greater part of bridge, about 9 ft. below top of top chord. Feb. 9: Depth of foundations; pier protectors; superstructure design; substructure; concrete heating and mixing plant. Feb. 16: Excavation; cofferdam bracing; concrete work; riprap pier protection. Mar. 2: Engineering and construction features.

BUSES

TROLLEY. Trolley Buses (Les trolleybus). M. Perrousset. Société Française des Electriciens—Bul., vol. 6, no. 61, Sept. 1926, pp. 1064-1074. Compares various installation and running costs for trolley buses, street cars and gasoline buses, both in case of new development and in case of modification of existing street-car system.

C

CABLES, ELECTRIC

THREE-CONDUCTOR. Inductive Losses in Three-Conductor Type H Cables, D. M. Simons. Elec. Jl., vol. 24, no. 3, Mar. 1927, pp. 115-116. From calculated and experimental data, it is clear that induced losses in present-day Type H cable are smaller than quantities which are usually considered negligible, and thus there is no necessity for use of any special means of preventing them.

CARBON DIOXIDE

LIQUID, VAPOR PRESSURE OF. The Vapor Pressure of Liquid Carbon Dioxide, C. H. Meyers and M. S. Van Dusen. Refrig. Eng., vol. 13, no. 6, Dec. 1926, pp. 180-185. 3 figs. Vapor pressure was measured by static method over whole temperature range from triple point to critical point with accuracy of 1 part in 10,000.

CASE HARDENING

NITRATION. Nitration Hardening. Machy. (Lond.), vol. 29, no. 741, Dec. 23, 1926, pp. 393-395, 5 figs. New gas process for case-hardening steel parts developed by Krupps.

CAST IRON

ABRASIVE RESISTANCE. The Resistance to Wear of Cast Iron in the Case of Sliding Friction. Foundry Trade Jl., vol. 35, no. 549, Feb. 24, 1927, pp. 173-174. Results of experiments carried out by O. H. Lehmann. Translated from Giesserei-Zeitung, nos. 21, 22, 23, Nov. 1, 15 and Dec. 1, 1926. See reference to original article in Eng. Index, 1926, p. 127.

AUTOMOTIVE INDUSTRY. Cast Iron in Its Relation to the Automotive Industry, E. J. Lowry. Soc. Automotive Engrs.—Jl., vol. 20, no. 2, Feb. 1927, pp. 277-290, 13 figs.

GRAPHITIZATION. Influence of Carbon and Silicon on the Graphitization of White Castings (Influence du carbone et du silicium sur la graphitisation des fontes blanches), P. Chevenard and A. Portevin. Académie des Sciences—Comptes Rendus, vol. 183, no. 25, Dec. 20, 1926, pp. 1283-1284, 1 fig.

HEAT TREATMENT. The Heat-Treatment and Growth of Cast Iron, J. W. Donaldson. Foundry Trade Jl., vol. 35, nos. 548 and 549, Feb. 17 and 24, 1927, pp. 143-146 and 167-169 and (discussion) 169-171, 13 figs. Account of series of heat-treatment tests carried out on iron cast by filter process.

SULPHUR IN. Limitation of Sulphur Effect for Ordinary Cast Iron. Soc. Mech. Engrs. (Japan)—Jl., vol. 30, no. 118, Feb. 1927, pp. 47-74, 15 figs. Determination of permissible amount of sulphur in ordinary iron castings for machine construction, mostly by means of mechanical and microscopic test. (In Japanese.)

CENTRAL STATIONS

DES MOINES, IOWA. Des Moines Power Station of the Iowa Power and Light Company, R. K. Lane. Iowa Eng. Soc.—Proc., vol. 1, no. 4, Oct. 1926, pp. 51-56.

DIESEL-ENGINED. Street-Car Power Plant Dieselized. Oil Engine Power, vol. 5, no. 3, Mar. 1927, pp. 152-154, 3 figs. Guayaquil, Ecuador, power station substitutes Diesels for steam without service interruption.

EAST RIVER, NEW YORK CITY. New East River Station of New York Edison Co. Power, vol. 65, no. 11, Mar. 15, 1927, pp. 390-397, 16 figs. Details of equipment, heat balance, etc.

The New East River Station of the New York Edison Co. Opens, J. W. Lieb. Universal Engr., vol. 45, no. 3, Mar. 1927, pp. 23-30, 9 figs. Ultimate capacity of plant will be over 1,000,000 kw.

LOCATION. Location of Central Power Plants and Coal Selection, S. A. Taylor. Power, vol. 65, no. 8, Feb. 22, 1927, p. 285. Summary of problems drawn from experience in picking location for plant and in securing fuel and water necessary for operation; few mine-mouth locations justified. (Abstract.) Paper presented before Midwest Power Conference, Chicago.

CHROMIUM

PROPERTIES AND USES. Chromium—Its Properties and Uses, C. G. Fink. Soc. Automotive Engrs.—Jl., vol. 20, no. 1, Jan. 1927, pp. 157-160.

CHROMIUM STEEL

PROPERTIES. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 11, no. 3, Mar. 1927, pp. 450-463, 4 figs. Influence of chromium upon properties of steel; Guillet's diagram showing structural composition of steels of varying chromium and carbon contents; composition, properties, uses and methods of heat treating of number of types of chromium steel; stainless steel and principles of corrosion.

CITY PLANNING

TERMINALS, IMPORTANCE OF. The Importance of Terminals in Regional Planning, H. M. Lewis. World Ports, vol. 15, no. 5, Mar. 1927, pp. 562-572 and (discussion) 572-585. Purpose of regional planning; increase of terminal traffic in New York; present New York terminals; including passenger, carfloat, shipping and air terminals.

COAL

ASH, CLINKERING CHARACTERISTICS. Fusibility of Coal Ash as Related to Clinker Formation, W. A. Selvig, P. Nicholls, W. L. Gardner and W. E. Muntz. Carnegie Inst. of Technology, Min. & Met. Investigations—Bul., no. 29, 1926, 64 pp., 11 figs. Investigation to determine some property of coal ash susceptible to reasonably accurate measurement in laboratory which would serve as index to its clinkering characteristics in boiler furnaces.

CARBON RATIOS AS INDEX OF OIL PROSPECTS. Carbon Ratios of Coal as an Index of Oil and Gas Prospects in Western Canada, G. S. Hume. Can. Min. & Met. Bul., no. 179, Mar. 1927, pp. 325-345. Survey of all carbon ratios in relation to known occurrences of oil and gas seems to show that predictions regarding occurrence of oil and gas can be safely made where carbon ratios are of proper magnitude.

CHEMICAL RELATIONS. The Chemical Relations of the Principal Varieties of Coal, G. Hickling. Instn. Min. Engrs.—Trans., vol. 72, Feb. 1927, pp. 261-276 and (discussion) 276-281, 7 figs. partly on supp. plates. Study to ascertain whether, among wide range of chemical composition shown by fossil vegetable deposits, there are any compositions which by special frequency of occurrence might suggest developments of products of chemically more stable type, or whether there are no such predominating types.

CLEANING. Fine-Coal Cleaning by the Hydrotator Process, W. L. Remick. Am. Inst. Min. & Met. Engrs.—Trans., no. 1658-F, Mar. 1927, 11 pp. Process was developed as economic necessity to meet ever-increasing demand for inexpensive method of cleaning coal down to sizes ordinarily referred to as dust; field of application of process.

DRYING. Continuous Centrifuges Particularly Adaptable to Drying Finer Sizes of Coal, F. J. G. Duck. Coal Age, vol. 31, no. 6, Feb. 10, 1927, pp. 219-224, 12 figs. Rapid and efficient drying of mixed sizes of coal can be accomplished by new types of centrifuges; fines can be recovered and moisture content reduced to from 4 to 18 per cent.

PULVERIZED. *See Pulverized Coal.*

COAL HANDLING

PNEUMATIC PLANTS. Handling Coal Pneumatically at the Sittingbourne Works of Edward Lloyd, Limited. Iron & Coal Trades Rev., vol. 114, no. 3076, Feb. 11, 1927, pp. 215-217, 6 figs. Pneumatic plant for handling boiler fuel.

Pneumatic Coal and Ash Conveying Plant. Engineer, vol. 143, no. 3709, Feb. 11, 1927, pp. 163-166, 9 figs., partly on p. 160. Plant erected at Trafford Power Station, Manchester, Eng.: comprises suction plant for discharging coal which arrives either by barge or railway car and for bringing fuel from reserve dumps; mechanical conveyors for transferring coal to storage bunkers, and suction system to clear ashes from boilers.

Pneumatic Handling of Coal, Flue Dust and Ashes. Eng. & Boiler House Rev., vol. 40, no. 9, Mar. 1927, pp. 464-471, 4 figs. Details of plant made by Pneumatic Conveyance and Extraction, Ltd.; principles of induction system of pneumatic conveying; advantages of system.

COAL INDUSTRY

FUTURE PROSPECTS. Looking Into the Future of the Coal Industry, W. Barnum. Min. & Met., vol. 8, no. 243, Mar. 1927, pp. 118-121. Relationship between engineer and coal operator; suggests that coal operators and engineers, where there are universities with coal-mining courses, consider advisability of establishing advisory boards to function as closely as possible; review of developments.

COAL MINES

CONCRETE. Concrete in Mines. Concrete & Constr. Eng., vol. 22, no. 2, Feb. 1927, pp. 163-165, 4 figs. New method of lining mine galleries, linings and shafts, invented by H. Schaeffer; it is based on theory that before creation of hollow space in shape of mine gallery, mass of rock is in state of equilibrium.

VENTILATION. The Measurement of Air Quantities and Energy Losses in Mine Entries, A. C. Callen and C. M. Smith. Univ. of Ill.—Bul., vol. 24, no. 6, Oct. 12, 1926, 72 pp., 22 figs. Primary object of investigations was to see whether pitot-tube transversing methods could be applied with reasonable accuracy at any desired location without building measuring station and without special preparation of section; as secondary feature, it was planned to secure pressure-loss data in conjunction with velocity measurements in order to obtain information on magnitude of so-called "friction" losses, as well as of losses due to splitting, special resistances, etc.

COAL MINING

CUTTING METHODS. Various Methods of Cutting Coal, W. R. Jarvis. Engrs'. Soc. West. Penn.—Proc., vol. 42, no. 8, Nov. 1926, pp. 397-402 and (discussion) 403-409. There is tendency towards use of revolutionary methods of cutting coal, and this tendency should be given careful consideration so as to determine which of following is most feasible: (1) introduction of long-wall or modified long-wall system, using long-wall mining machines and face conveyers; (2) introduction of shearing cut put in by shearing machine as complement to undercut or top cut; (3) use of combination track-cutting machine which will both undercut and shear.

MACHINE LOADING. Mechanical Loading and Coal Mine Management, H. F. McCullough. Min. & Met., vol. 8, no. 243, Mar. 1927, pp. 129-130. Loading is pivotal operation in mining of coal and is linked together with transportation so that they must be co-ordinately operated. Presented at joint meeting of Chicago Sections of A.S.M.E. and A.I.M.E.

Mechanical Loading and Coal Mine Management, H. F. McCullough. Mech. Eng., vol. 49, no. 3, Mar. 1927, p. 261. It may be true that most important immediate benefit to be obtained from mechanical loading and conveying equipment will be that, before installing them, operators will be compelled to improve mining practices in order to justify use of new equipment. Abstract of paper presented at joint meeting of Chicago Sections of A.I.M.E. and A.S.M.E., Chicago.

Loader is Making Its Best Record After Nearly Two Years of Continuous Service. Coal Age, vol. 31, no. 11, Mar. 17, 1927, pp. 394-395, 3 figs. Has increased mine capacity by 6,000 tons per month; bigger lumps are evident, with no change in percentage of nut and slack; new standard of mine superintendence required with mechanical loaders.

STRIPPING. Strip Coal Mining with Liquid Oxygen, E. S. Bisbee. Compressed Air Mag., vol. 32, no. 3, Mar. 1927, pp. 1959-1963, 11 figs. Stripping with liquid oxygen; this explosive has proved very efficient and economical in clearing away overburden.

COAL WASHING

FLOTATION. The Sand Flotation Process for the Cleaning of Anthracite and Bituminous Coals, T. M. Chance, W. Emery, Jr. and M. A. Walker. Min. Congress Jl., vol. 13, no. 3, Mar. 1927, pp. 207-214 and 245, 6 figs. Used for both anthracite and bituminous coals; enables direct conversion of steam sizes into low ash briquets; increases domestic sizes; produces uniform product, regardless of source; reduces labour, capital and operating costs.

COLD STORAGE

REFRIGERATING DUTY REQUIRED BY. Cold Storage Operation Data, G. A. Horne. Refrig. Eng., vol. 13, no. 6, Dec. 1926, pp. 177-179 and 185, 3 figs. Data covering refrigerating duty required by cold storage warehouse for complete year, including average tons of refrigeration month by month, weight of goods handled in and out and few figures representing costs of power-plant operation.

COMBUSTION

CONTROL. Automatic Control of Combustion, T. A. Peebles. Engrs'. Soc. West. Penn.—Proc., vol. 42, no. 9, Dec. 1926, pp. 455-459 and (discussion) 459-464. Automatic control is especially valuable in plants where boilers are operated at capacity far below their maximum; in burning of powdered coal disturbing effect of fuel-bed conditions is done away with, and for this reason control is simplified.

COMMUTATORS

MAINTENANCE. Commutator Maintenance, C. O. Mills. Power, vol. 65, no. 9, Mar. 1, 1927, pp. 323-325, 8 figs. Faults that may develop in commutator of direct-current machine, with suggestions as to how these faults may be remedied.

CONCRETE

BOND BETWEEN STEEL AND. Bond Between Concrete and Steel, W. D. Womersley. Concrete & Constr. Eng., vol. 22, no. 2, Feb. 1927, pp. 153-159, 5 figs. Investigation of bond resistance between concrete and steel, in which steel bar is embedded for certain length in concrete and then withdrawn by application of axial pull; in first series of experiments, steel plate was set up vertically and two rectangular blocks of concrete cast, one on each side; in second series, 3-in. diameter concrete cylinders were cast with their axes vertical and with their bases resting on hard steel disks; these specimens were set up in torsion testing machine and steel disks twisted off by application of pure couple.

DETERIORATION IN SEA WATER. Deterioration of Concrete in Sea Water and Preventative Methods, G. F. Nicholson. Pacific Mar. Rev., vol. 24, no. 2, Feb. 1927, pp. 64-67, 3 figs. Causes of deterioration; chemical action of sea water on concrete; oxidation of reinforcement; illustrations of deterioration; solid fill as solution; pressure treating with asphalt; concrete cylinder. Paper read before Pacific Coast Assn. of Port Authorities.

CONDENSERS, STEAM

TUBES. Chemicals Effective as Condenser Tube Cleaner, L. M. Forncrook. Power Plant Eng., vol. 31, no. 5, Mar. 1, 1927, pp. 298-300, 5 figs. Tests show both mechanical and chemical cleaning methods effective, but chemicals are preferable in severe cases; oxide on outside of tube prevents any cleaner from making old tube as effective as new ones.

CONDUITS

PRESSURE. Determination of Maximum Economic Dimensions of a Metal Pressure Conduit and Its Application to Practical Calculations (La solution générale du problème de la détermination des dimensions économiques maximum d'une conduite forcée en métal et son application aux calculs pratiques), P. S. Rini. Houille Blanche, vol. 25, no. 119-120, Nov.-Dec. 1926, pp. 161-164. Presents general solution of problem.

The Design of Turbine Pipe Lines, R. Horowitz. AEG Progress, vol. 2, no. 12, Dec. 1926, pp. 348-358, 22 figs. In designing pipe lines, following factors must be determined; amount of water flowing per unit of time, pressure occurring and pipe track; consideration of material employed, including cast iron, wrought iron, steel, concrete and wood; determination of internal diameter; calculation of wall thickness; laying pipe lines.

CONNECTING RODS

ARTICULATING. The Articulated Connecting Rod—An Alternative Method for Finding Accelerations, W. S. Farrien. Roy. Aeronautical Soc.—Jl., vol. 31, no. 195, Mar. 1927, pp. 234-236, 2 figs.

COUNTERBALANCED. Possibilities of the Counterbalanced Connecting-Rod, K. D. Wood. Soc. Automotive Engrs.—Jl., vol. 20, no. 3, Mar. 1927, pp. 397-401, 6 figs.

CONSTRUCTION, CONCRETE

POWER PLANTS. Building a Concrete Industrial Power House of Unusual Design, W. W. Hay. Concrete, vol. 30, no. 3, Mar. 1927, pp. 29-31, 6 figs. Difficult location and unstable foundation conditions necessitated unusual design; built on reinforced-concrete mattress; derrick hoists concrete for superstructure.

CONVERTERS

ROTARY. The Excitation of Reactance-Controlled Rotary Converters, R. G. Jakeman. World Power, vol. 7, no. 39, Mar. 1927, pp. 130-136, 9 figs. Armature reaction due to wattless current; open-circuit characteristic of rotary converter; load characteristics and power factor; inverted running.

CONVEYORS

BELT. Selection, Installation and Care of Belt Conveyors, W. E. Phillips. Cement Mill & Quarry, vol. 30, no. 5, Mar. 5, 1927, pp. 19-25, 2 figs. To take utmost advantage of possibilities that belt conveyor offers, four things are required: (1) low coefficient of friction with its attendant low power consumption; (2) long belt life; (3) low rate of depreciation, and (4) low maintenance cost; service given by conveyor depends on construction of idlers.

The Belt Conveyor and Its Advantages. Indus. Mgmt. (Lond.), vol. 14, no. 2, Feb. 1927, pp. 47-48. Advantages of band conveyor over any other type of conveyor.

Unusual Conveyor Problem at Cincinnati Plant, R. A. Goodwin. Cement Mill & Quarry, vol. 30, no. 3, Feb. 5, 1927, pp. 18-20, 5 figs. One of longest belt conveyors in sand and gravel industry was installed at plant of Ohio Gravel Ballast Co., Cincinnati; belt is supported on rollers equipped with Timken roller bearings; entire structure which carries belt is of steel; rubber belt for both conveyors.

DUAL. Dual or Multi-Purpose Conveyors, G. F. Zimmer. Indus. Mgmt. (Lond.), vol. 14, no. 2, Feb. 1927, pp. 41-46 and 50, 7 figs. Conveying appliances by means of which, in addition to conveying from place to place of material, such subsidiary functions as sifting, picking over, assembling, painting, enameling, heating, cooling, etc., are carried out at same time.

ELECTRIC DRIVE. Application of Electric Drive to Conveyors, R. F. Emerson. Eng. World, vol. 30, no. 3, Mar. 1927, pp. 143-150, 14 figs. Describes more important and generally used types of conveyors, together with their load characteristics and sort of work to which they are most adaptable; power requirements; different types of a.c. and d.c. motors and their control.

COPPER ALLOYS

HARDENABLE. Notes on the Atomic Behaviour of Hardenable Copper Alloys, E. C. Bain. Am. Inst. Min. & Met. Engrs.—Trans., no. 1657-E, Feb. 1927, 8 pp., 3 figs. Results of investigation to discover fundamental atomic conditions existing in Corson's high-copper alloys hardenable by means of silicide solution and reprecipitation; results show that very perfect crystallinity exists in solid solutions prepared at high temperature to contain as much dissolved silicide as possible.

NICKEL SILVER. Casting of Nickel Silver, H. Mappin. Metal Industry (Lond.), vol. 30, no. 6, Feb. 11, 1927, p. 164. Casting consists in heating constituent metals together, and resultant alloy is poured into mould and finally removed as solid ingot; nickel silver, which is alloy of copper, nickel and zinc, is hard bright metal and, owing to its high malleability and ductility, it is produced in enormous quantities for manufacture of electroplated articles.

CORE OVENS

ELECTRIC. Electric Ovens Used in Baking of Cores, I. S. Wishoski. Fuels & Furnaces, vol. 5, no. 3, Mar. 1927, pp. 331-336, 6 figs. Ten electrically-heated ovens used in baking of cores are equipped with automatic time and temperature controls and provided with ingenious ventilating system.

COST ACCOUNTING

MACHINE-HOUR RATE. The Machine-Hour Rate, G. W. Tripp. Machy. (Lond.), vol. 29, no. 745, Jan. 20, 1927, pp. 516-518, 1 fig. Simple method of determining overhead; principal constituents of overhead; charges which vary for each machine; saving of clerical work by grouping; example of application; advantages of machine-hour rate.

CRANES

AUSTRIAN TYPES. Modern Hoisting Equipment (Neuere Hebezeuge), R. Dub. Fördertechnik u. Frachtverkehr, vol. 19, nos. 24, 25 and 26, Nov. 26, Dec. 10 and 24, pp. 367-372, 387-390 and 403-407, 15 figs. Details and types of new cranes built in Austria.

GIRDER DESIGN. The Economics of Crane Girder Design, E. G. Fiegehen. Engineer, vol. 143, no. 3711, Feb. 25, 1927, pp. 204-205, 1 fig. Discusses types of girders in common use, namely: rolled steel joists, plate-web girder with single or double webs, lattice-web girders and 4-girder construction with horizontal bracings.

INGOT TONGS. The Gripping Force of Ingot Tongs, W. E. Wright. Engineering, vol. 123, no. 3190, Mar. 4, 1927, pp. 274-275, 6 figs. Investigations in order to discover reason why set of gripping tongs on newly-built soaking-pit crane would not grip as desired; crane was intended to handle ingots, thickness of which varied from 8 to 20 in.; action of tongs and calculation of forces involved.

CULVERTS

EARTH PRESSURES ON PIPES. Earth Pressures on Culvert Pipes, G. M. Braune. Pub. Roads, vol. 7, no. 11, Jan. 1927, pp. 222-229, 19 figs. Results of experiments on private roadway near Chapel Hill, N.C.; tests so far performed confirm theory on culvert pipes, namely, that pressures vary inversely as some power of deflection of pipe; values were obtained of ratio of actual earth pressure to weight of prism of earth directly over pipe.

D

DAMS

SEEPAGE PROTECTION. Protection Against Seepage at Lake Kenogami, O. O. Lefebvre. Eng. Jl., vol. 10, no. 3, Mar. 1927, pp. 135-137, 2 figs. Preliminary investigations, features governing choice of type of dam, construction methods and records of results attained.

DIES

ADJUSTABLE PUNCHES. Progressive Die with Adjustable Punches, F. Server. Machy. (N.Y.), vol. 33, no. 7, Mar. 1927, pp. 502-504, 4 figs. One of principal objects in designing die was to provide means for adjusting independently forming punches which advance from sides and form small eyes on edges of work; die is designed to take flat steel sheared to required width and in standard lengths of 14 ft.

FORMING. Forming Dies for a Tapered Tube, E. Heller. Machy. (N.Y.), vol. 33, no. 7, Mar. 1927, pp. 487-489, 7 figs. Making die blocks for tapered section; turning blocks for forming punch; difficulty in shaping tube.

DIESEL ENGINES

FUEL INDICATORS. The Baulino Continuous Fuel Indicator. Engineer, vol. 143, no. 3709, Feb. 11, 1927, pp. 157-158, 2 figs. Apparatus developed by C. Baulino and adopted by Italian Navy for use on submarine engines; it contains no moving parts and depends on application of known principles of hydrodynamics.

FUEL VALVES. Setting the Fuel Valve of an Air-Injection Diesel, A. B. Newell. Power, vol. 65, no. 10, Mar. 8, 1927, pp. 369-370, 2 figs. Most accurate method is what is known as "setting with air"; by this method crank is first set at correct angle; then air inlet valve is blocked open, commonly by slipping thin block of wood between roller and cam to hold them apart; it will then be possible to hear what is going on within cylinder by listening at air-inlet breather pipe.

POWER COSTS. What Are Diesel Engine Power Costs? H. C. Thuerk. Elec. World, vol. 89, no. 10, Mar. 5, 1927, pp. 493-496, 4 figs. Operating data from 58 Diesel-engine power plants taken as basis for computing fixed charges, operating and maintenance costs.

DRAINAGE

HIGHWAYS. Erosion and Its Prevention, C. E. Gross. Iowa Eng. Soc.—Proc., vol. 1, no. 4, Oct. 1926, pp. 59-63, 4 figs. Author presents typical erosion problems that have claimed attention and methods employed to solve them; although cases mentioned apply to drainage problems, these methods, it is believed, could be applied along highways in side ditches wherever undue erosions occur similar to ones described.

DRAWINGS

DRAUGHTING-ROOM ROUTINE. Some Observations Upon Drawing Office Routine, J. D. Tiffen and J. F. Lancaster. Surveyor, vol. 71, no. 1830, Feb. 18, 1927, pp. 215-217. System employed in Warwickshire County surveyor's office: deals with work and general routine of technical department.

DREDGES

TYPES. Dredges and Some Dredging Problems, W. E. Bonn. Can. Engr., vol. 52, no. 7, Feb. 15, 1927, pp. 217-219, 3 figs. Principal types of dredge and most suitable operating conditions for each; operating hydraulic dredges and arrangement of disposal areas; employment of booster pumps.

DURALUMIN

HEAT TREATMENT. The Heat Treatment of Duralumin, W. Nelson. Aviation, vol. 22, no. 8, Feb. 21, 1927, pp. 362, 365, 2 figs. When certain light aluminum alloys are heat treated, quenched and aged, there is considerable improvement in their tensile properties; there is leaning towards use of electric furnaces for heat treating this alloy to reduce possible dangers of corrosion from nitrate salts used in baths; this measure appears desirable, but uniformity of heating and accurate control of temperature, both obtainable with salt baths, are very important factors.

E

EDUCATION, ENGINEERING

CURRICULA. A Study of Engineering Curricula, W. C. John. Jl. Eng. Education, vol. 17, no. 5, Jan. 1927, pp. 454-513, 17 figs. Deals with requirements for entrance and for graduation in colleges which grant first degrees in engineering.

A Study of Evolutionary Trends in Engineering Curricula. Jl. of Eng. Education, vol. 17, no. 6, Feb. 1927, pp. 551-585, 11 figs. Traces trend of evolution in five major engineering curricula in order that their present state may be defined in terms of direction as well as position.

ELECTRIC CURRENTS

TRANSIENT. A Simplified Method of Calculating Transients in Parallel Circuits, B. S. Cain. Gen. Elec. Rev., vol. 30, no. 3, Mar. 1927, pp. 129-134, 8 figs. No calculus required; accounts for mutual inductance; similarity to a.c. vector analysis; 4 typical problems solved.

ELECTRIC DISTRIBUTION SYSTEM

AUTOMATIC CONTROL. Automatic Control for A.C. Distribution Systems, H. A. McCrea. Elec. Light & Power, vol. 5, no. 3, Mar. 1927, pp. 21-23, 92 and 94, 7 figs. A.c. reclosing feeder equipment has probably most widespread application of any type of automatic control; when transformer banks are controlled by automatic devices, it is also customary to provide additional protective devices to take care of trouble.

ELECTRIC FURNACES

DIAGRAM FOR. A Diagram for Electric Furnaces (Diagramme de fonctionnement des fours électriques), J. Bethenod. Revue Générale de l'Électricité, vol. 20, no. 20, Nov. 13, 1926, pp. 697-698, 1 fig. Refers to work by E. de Loisy, published in Revue de Métallurgie, May 1926, developing critical analysis of previous work by P. Bergeon and E. Rieke. See brief translated abstract in Sci. Abstracts (Sect. B), vol. 30, part 2, Feb. 25, 1927, pp. 74-75; and reference to article by de Loisy in Eng. Index 1926, p. 257.

HEAT-TREATING. Heat-Treating of Castings in Electric Furnaces, J. L. Faden. Fuels and Furnaces, vol. 5, no. 2, Feb. 1927, pp. 225-226, 3 figs. Castings for machine parts at Whitin Machine Works, Whitinsville, Mass., are carburized and annealed in six box-type electric furnaces which were recently installed.

HIGH-FREQUENCY. Contributions to the Theory of High-Frequency Electric Furnaces (Etude théorique du rendement du four électrique à haute fréquence alimenté par alternateur), M. G. Ribaud. Jl. de Physique et le Radium, vol. 7, no. 8, Aug. 1926, pp. 250-256, 1 fig. Supplementary to article upon high-frequency furnaces, published in same journal in 1923; mathematical calculations made by Northrup relating to use of alternating currents for high-frequency furnaces are criticized as being based upon unreliable hypotheses and results obtained by him are considered untrustworthy. See brief translated abstract in Sci. Abstracts, (Section B), vol. 30, part 1, Jan. 25, 1927, p. 21.

MELTING. Electric Furnaces for Melting Metal. Forging—Stamping—Heat Treating, vol. 12, no. 2. Feb. 1927, pp. 41-43. Limitations and applications of electric furnace; alloy and tool steels; steel castings; cast iron; economics of electric melting; malleable iron; permanent-mould castings; non-ferrous metallurgy; electric heating furnaces; electrode control; high-frequency furnace.

ELECTRIC GENERATORS

REGULATORS. Operation and Adjustment of Automatic Load Regulators for Electric Generators, F. A. Byles. Power, vol. 65, no. 8, Feb. 22, 1927, pp. 281-283, 6 figs. Describes operation of two different types of regulators and explains how these equipments are put into service and adjusted.

ELECTRIC GENERATORS, A.C.

SYNCHRONOUS. Impedance of a Rotating Synchronous Machine to a Negative Sequence Voltage, C. F. Wagner and A. Dovjikov. Elec. Jl., vol. 24, no. 3, Mar. 1927, pp. 117-121, 20 figs. To evaluate additional currents, which are determined by impedance of rotating a.c. machine to that voltage, sequence of whose maxima is in direction opposite to direction of rotation of machine, or, in other words, to negative sequence voltage, theory of symmetrical co-ordinates was applied and several experimental measurements of impedances to negative sequence voltage were made.

ELECTRIC METERS

INSULATION-BREAKDOWN TEST. Meter-Insulation Breakdown Test, C. J. Fuhrmann. Elec. World, vol. 89, no. 11, Mar. 12, 1927, p. 562, 1 fig. Device to check insulation of all meters passing through electric-meter laboratory of Consumers' Power Co. before they are reinstalled in service.

ELECTRIC MOTORS

SELECTION. Selection of Motors and Controllers, G. Fox. Blast Furnace & Steel Plant, vol. 15, no. 3, Mar. 1927, pp. 118-124, 2 figs. Many factors which contribute to selection of appropriate electrical equipment treated in comprehensive manner; motor characteristics analyzed.

ELECTRIC POWER

TRANSMISSION OVER GREAT DISTANCES. A Technical and Economic Analysis of Electric Power Transmission, G. D. Floyd. Elec. News, vol. 36, no. 4, Feb. 15, 1927, pp. 29-32 and 46, 8 figs. Outlining method of procedure for studies covering distances in excess of 100 miles.

ELECTRIC TRANSMISSION LINES

A.C. NETWORK. Serving a Medium-Voltage A.C. Network, D. K. Blake. Elec. World, vol. 89, no. 10, Mar. 5, 1927, pp. 501-503, 5 figs. Load areas served by ideal layout of substations and feeders; reduction of copper and copper losses obtained; simple switching arrangements.

CONSTRUCTION. Holes Dug and Poles Set from Flat Car. Elec. World, vol. 89, no. 11, Mar. 12, 1927, pp. 559-560, 4 figs. Mechanical aids employed to expedite transmission-line construction in face of almost insurmountable obstacles.

QUEBEC. 187-Kv. Line, Isle Maligne to Quebec. Elec. News, vol. 36, no. 4, Feb. 15, 1927, pp. 33-35, 5 figs. Outline of general characteristics; capacity of two circuits will be 150,000 h.p.

ELECTRIC WELDING, ARC

PIPE. Pipe Welding, J. F. Lincoln. Am. Welding Soc.—Jl., vol. 6, no. I, Jan. 1927, pp. 8-14, 5 figs. Deals with automatic arc welding of pipe and hand welding of field joints for construction of pipe line.

STEEL PIPES. Arc Welded Steel Pipe for High-Pressure Mains for New York City, W. Schenstrom. Am. Welding Soc.—Jl., vol. 6, no. 2, Feb. 1927, pp. 30-36. First section of large-size diameter, electrically welded water pipe to be installed in large city in United States; it is 48-in. I.D. pipe made of ½-in. flange steel, welded inside and out; results of tests.

STRUCTURAL STEEL. Electric Arc Welding of Steel Structures—Design and Organization, H. E. Grove. Am. Welding Soc.—Jl., vol. 6, no. 1, Jan. 1927, pp. 24-40, 16 figs. Outline of procedure adopted in Commonwealth of Australia by superintendent of Metropolitan Gas Co.

ELECTRICAL MACHINERY

COOLING. Experiments on Forced Air Cooling of Electrical Machinery, H. Wills. World Power, vol. 7, no. 38, Feb. 1927, pp. 82-90, 8 figs. Results of experiments made on forced air-cooled machine to determine relationship between watt loss, machine temperature rise and rate of flow of cooling medium; and also relationship between these quantities and temperature rise of cooling medium in passing through machine.

STANDARD PERFORMANCES. Standard Performances for Electrical Machinery, F. T. Chapman. Elec. Rev., vol. I00, nos. 2569 and 2570, Feb. 18 and 25, I927, pp. 250-251 and 292-293. Critical review and observations on specifications nos. 169 and 226, dealing with working requirements of motors and generators, of British Engineering Standards Association.

ELECTRICITY SUPPLY

RATE CALCULATION. Rapid Calculation of Rate Curves, H. E. Eisenmenger. Elec. World, vol. 89, no. 11, Mar. 12, 1927, pp. 547-548. Short-cut method proposed which is intended to reduce rate-curve calculation largely to mental arithmetic.

ELEVATORS

AUTOMATIC. Electric Elevator Practice, F. L. Boissonnault. Elec. Jl., vol. 24, no. 3, Mar. 1927, pp. 111-114, 9 figs. Automatic elevators; auxiliary apparatus; dual control; brakes.

EMPLOYMENT MANAGEMENT

RAILWAYS. Training Understudies fur Executives in Railroad Service, W. J. Cunningham, J. J. Hill. New York Railroad Club—Official Proc., vol. 37, no. 4, Mar. 1927, pp. 8265-8303.

SELECTING EMPLOYEES. Elimination Work in the Selection of Personnel. Mech. Eng., vol. 29, no. 3, Mar. 1927, p. 218. Waste elimination in selection of personnel demands job analysis, personality analysis and job betterment in order that best opportunities may be made available for workers and that as exact information as possible may be on hand in regard to type of work which worker is expected to do.

ENERGY

THERMAL, OCEAN WATERS, AS SOURCE OF. The Utilization of Natural Luke-Warm Waters (A propos de l'utilisation des eaux tièdes naturelles), P. Drosne. Chaleur & Industrie, vol. 8, no. 81, Jan. 1927, pp. 3-8, 3 figs. Points out that laws of evolution of hot or luke-warm liquids will greatly aid in technical problems of boilers, carburetors, etc.; utilizable and non-utilizable energies; ocean waters as source of thermal energy.

Utilization of the Thermal Energy of Tropical Seas (L'utilisation de l'energie thermique des mers tropicales). Génie Civil, vol. 90, no. 3, Jan. 15, 1927, p. 82. Also brief translated abstract in Power Engr., vol. 22, no. 252, Mar. 1927, p. 116.

F

FILTRATION

MECHANISM. Mechanism of Filtration. A. W. Hixson, L. T. Work and I. H. Odell, Jr. Am. Inst. Min. & Met. Engrs.—Trans., no. 1541-B, Feb. 1926, 10 pp., 8 figs. Survey of certain fundamental principles of filtration; size of particles and of filter opening; microscopic examination of cake; concentrations of solids and particle arrangement; as particles become smaller, larger number form bridge; use of thick pulps desirable.

FIRE EXTINGUISHERS

CARBON-DIOXIDE. Carbon-Dioxide Used to Extinguish Fires in Electrical Equipment, C. C. C. Ragsdale. Power, vol. 65, no. 10, Mar. 8, 1927, pp. 356-358, 3 figs. In principle, system consists of battery of tanks of compressed CO_2 connected by pipes to compartments and housing of electrical equipment in which fire may occur.

ELECTRIC GENERATORS. Generator Fire Extinguishing System at Edgar Station, G. R. Davison. Elec. World, vol. 89, no. 11, Mar. 12, 1927, pp. 545-547, 6 figs. Multi-cylinder installation employs liquid CO_2 under 850 lb. pressure; tests show 20 per cent content can be obtained in 15 sec.; excess gas content desirable precaution against air leakage.

FLOTATION

SELECTIVE. Selective Flotation and Its Relation to Metallurgy, L. O. Howard. Black Hills Engr., vol. 15, no. 1, Jan. 1927, pp. 14-28, 7 figs. Reviews developments of recent years. Bibliography.

FLOW METERS

CARE AND INSPECTION. Care and Inspection of Electric Steam-Flow Meters, J. E. Housley. Power, vol. 65, no. 8, Feb. 22, 1927, pp. 288-290, 5 figs. Author tells how he takes care of his steam-flow meters and checks their operation.

FLOW OF WATER

SECTOR REGULATORS. Sector Regulators, F. J. Taylor. Water & Water Eng., vol. 29, no. 338, Feb. 21, 1927, pp. 47-49, 8 figs. Sector regulator is comparatively recent introduction and takes form of sector spanning opening through which water is intended to pass, but it does not shut down upon sill of opening, but sinks into pit to any predetermined depth, and thus maintains definite depth of water over it.

FLYWHEELS

HORSE POWER OUTPUT OF FLYWHEELS, B. J. Shillito. Mech. World, vol. 81, no. 2095, Feb. 25, 1927, pp. 137-138, 4 figs. Type of instrument that is quite suitable for such fine measurements consists of drum, driven from flywheel, either direct coupled to same or driven through spur gear without backlash.

FORGING

MACHINES. Forging Machines (Les machines à forger), L. Gendron. Pratique des Industries Mécaniques, vol. 9, no. 12, Mar. 1927, pp. 485-494, 20 figs. Points out defects of older types; safety devices; improvements in machine; machines for low-temperature forging; recent innovations.

FOUNDRIES

SCRAP, BRIQUETTING. Briquetting Cast-Iron Turnings and Borings. Machy. (Lond.), vol. 29, no. 710, Mar. 3, 1927, pp. 712-714, I fig. Methods of briquetting divide themselves into two classes, according to whether or not borings are subjected to high pressures, and methods may be classified under twu headings: (1) formation of briquettes using chemical binders, with or without moderate pressures; (2) formation of briquettes by means of high pressures, with or without use of chemical binders; grading of borings and turnings; remelting briquetted borings.

FUELS. *See Coal; Lignite; Oil Fuel; Pulverized Coal.*

FURNACES, HEATING

REGULATION OF ATMOSPHERES. Furnace Atmosphere is Regulated Automatically by Meters, R. Rimbach and J. A. Stein. Iron Trade Rev., vol. 80, no. 7, Feb. 17, 1927, p. 456. Regulation of furnace combustion conditions to give desired furnace atmospheres is accomplished by use of suitable flue-gas analyzing equipment so as to obtain better uniformity of product with lower fuel consumption; types of furnaces include sheet and pair, continuous annealing, heating and reheating furnaces for billets, open and box annealing, and certain forging furnaces; installation often consists of electric CO meter, which is sometimes augmented by electric CO_2.

FURNACES, INDUSTRIAL

DESIGN. Practical Industrial Furnace Design, M. H. Mawhinney. Forging—Stamping—Heat Treating, vol. 12, no. 2, Feb. 1927, pp. 44-47, 5 figs. Various methods of firing furnaces; fuel consumptions and dimensions of interior construction; principles of operation.

G

GAUGES

THREE-POINT. An Analysis of the Three-Point Gauge, E. A. Limming. Machy. (Lond.), vol. 29, no. 750, Feb. 24, 1927, pp. 674-676, 6 figs.

GAS MAINS

GAS CHANGEABILITY IN. Changeability of Gas in Mains, E. Ott. Am. Gas Jl., vol. 126, no. 11, Mar. 12, 1927, pp. 259-261, 268 and 270. Investigation of thermal value and other properties in distributing gas under low pressure.

GAS WELLS

GAS LIFTS. Dewatering Gas Wells by the Gas Lift, M. Walker. Min. & Met., vol. 8, no. 243, Mar. 1927, pp. 131-136, 8 figs. Gas wells can be made to dewater themselves by proper arrangements; theory and application of gas lift; results of experience.

GEAR CUTTING

GENERATORS. Spiral Bevel Gear Generating Machine, H. Shaw. Machy. (Lond.), vol. 29, no. 748, Feb. 10, 1927, p. 610, 3 figs. As high price of spiral bevel-gear machine is due to complications necessary to enable it to cut bevel gears of varying sizes, it would pay manufacturer who is continually producing bevel gears of one size in large quantities to install machines to produce only one size of gear, and in this way reduce cost of plant; presents principle upon which machine of this kind would work.

GEARS

EPICYCLIC. The Furness Gear. Auto-Motor Jl., vol. 22, no. 9, Mar. 3, 1927, pp. 189-190, 2 figs. Epicyclic gear which provides four forward speeds and reverse, with interesting form of control.

TRAIN FORMING CLOSED CIRCUIT. A Gear Problem—Comment, H. Walker. Machy. (Lond.), vol. 29, no. 749, Feb. 17, 1927, pp. 651-652, 3 figs. Describes gear train for multiple drilling machine; presents simple rule for design of gear trains which form closed circuit. Refers to article in same journal, Jan. 1927.

GIRDERS

RIVET PITCHES. Revised Rivet Pitch Formula Advocated as Time-Saver, A. Frank. Eng. News-Rec., vol. 98, no. 10, Mar. 10, 1927, p. 401. If static moment in moment-of-inertia equation could be replaced by available tabular quantities then moment-of-inertia method would be received much more favourably; presents derivation which was made with this end in view.

GLUES

MANUFACTURE AND PROPERTIES. Glues, H. Burdett. Roy. Aeronautical Soc.—Jl., vol. 31, no. 195, March 1927, pp. 255-262, 1 fig. Two most commonly used kinds of glues are casein and animal glues; essential qualities of good glue; manufacture of hide or skin glues and of bone glues.

GOLD DEPOSITS

EASTERN CANADA. The Geology and Mineral Deposits of the Harricanaw and Bell River Basins, G. W. Bain. Can. Min. & Met. Bul., no. 178, Feb. 1927, pp. 201-247, 28 figs. General, structural and economic geology; gold-bearing lodes are chief deposits sought for; claims and mines.

GOVERNORS

OIL-PRESSURES. The Working of an Oil-Pressure Governor Under Disturbed Flow (Etude analytique du fonctionnement, au cours d'une pertubation, d'un groupe électrogène pourvu d'un régulateur à pression d'huile), M. Barbillion. Houille Blanche, vol. 25, no. 117-118, Sept.-Oct. 1926, pp. 138-143, 5 figs. Explains mechanism of tachiometric oil-pressure governor of hydro-electric unit and follows its working under stress of varying velocities of flow, equations being included to calculate kinetic energy of unit in irregular feed; characteristic equation of operation of control is also worked out.

H

GRINDING MACHINES

INTERNAL. Internal Grinder Development, C. T. Appleton. Abrasive Industry, vol. 8, no. 3, Mar. 1927, pp. 87-89, 1 fig. Old-style machines necessitated hand plugging at consequent high-production cost; modern machines size work automatically.

HEAT TRANSMISSION

EXTERNALLY RIBBED TUBES. Transmission of Heat Through Walls of Externally Ribbed Tubes (Sur la transmission de la chaleur à travers les parois des tuyaux à ailettes), J. Merlan. Chaleur & Industrie, vol. 8, no. 81, Jan. 1927, pp. 13-19, 4 figs. Diffusion of heat from outside wall of tube to surrounding air takes place in two manners, namely, by direct radiation and by connection; explains difference between these two methods of transmission; influence of dimensions of rib on diffusive power of heat; conditions for employing ribbed tubes in heat exchanges.

HEATING AND VENTILATION

CHURCHES. Church Heating and Ventilation, A. J. Offner. Heat. & Vent. Mag., vol. 24, nos. 1, 2 and 3, Jan., Feb. and Mar. 1927, pp. 69-74, 72-76 and 68-71, 25 figs. Design problems in houses of worship as affected by their construction and use. Jan.: Location of ventilating system; arrangement for recirculation of air; example of warm-air heating; calculation of air temperatures and volumes. Feb.: Humidifying and rehumidifying; overhead air supply; air exhausted through pew ends; by-passing and control of air; up-feed supply system gravity-exhaust ventilation. Mar.: Ventilation of Sunday schools and social halls and choice of fuels for church heating.

HEATING, ELECTRIC

INDUSTRIAL. Industrial Electric Heat, N. J. Roberts. Nat. Elec. Light Assn.—Bul., vol. 13, no. 12, Dec. 1926, pp. 753-757, and vol. 14, nos. 1 and 2, Jan. and Feb. 1927, pp. 41-50 and 112-114, 20 figs. Dec.: Recent developments in apparatus; factors entering into costs; efficiency of electric heat; heat available for useful work at various temperatures. Jan.: Heat treatment of steel, melting of iron and steel, soaking pits; annealing of sheet and strip; melting of non-ferrous metals; induction furnaces. Feb.: Baking of bread and pastry; vitreous enameling; glass annealing.

HEATING, STEAM

BUILT-IN RADIATORS. Development of Built-in Heating Units, G. E. Otis. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 3, Mar. 1927, pp. 129-134.

CENTRAL. Design of a Small Community Heating Plant, H. L. Alt. Heat. & Vent. Mag., vol. 24, nos. 2 and 3, Feb. and Mar. 1927, pp. 66-68 and 76 and 65-67, 18 figs. Working out calculations and details for central plant and distributing mains.

HIGHWAYS

DESIGN AND COST CONTROL. The Control of Construction Unit Cost Through Design, T. W. Allen. Good Roads, vol. 70, no. 2, Feb. 1927, pp. 77-79. Discusses phase of design that affects construction costs; cutting mixing time; pavement loads; basic-unit production cost; length of haul. See also Roads & Streets, vol. 67, no. 2, Feb. 1927, pp. 74-77. (Abstract.) Paper read before Am. Road Builders' Assn.

LIGHTING. Demonstration of Highway Illumination, F. C. Taylor. Elec. World, vol. 89, no. 11, Mar. 12, 1927, pp. 549-550, 3 figs. Experimental installation of highway lighting; advantages of unit adopted and details of equipment erection.

WIDENING. Widening Trunk Lines vs. Building Parallel Highways, B. H. Petty. Mun. & County Eng., vol. 72, no. 1, Jan. 1927, pp. 27-32. Presents noteworthy examples of both pavement-widening projects and developments of parallel routes; presents arguments for and against each of two plans for relieving traffic congestion. See also Good Roads, vol. 70, no. 2, Feb. 1927, pp. 74-76 and 108.

HYDRAULIC TURBINES

HEAD INCREASE BY EXCESS FLOW. Using Excess Flow to Increase Head on Turbines. Power Plant Eng., vol. 31, no. 5, Mar. 1, 1927, pp. 314-316, 4 figs. Several devices for increasing head on hydraulic turbines by using excess water in high flow periods have proved economical and convenient at large hydro plants.

MODERN INSTALLATIONS Recent Turbine Installations, I. Moser. AEG Progress, vol. 2, no. 12, Dec. 1926, pp. 341-345, 4 figs. Recent installations by Escher Wyss & Co., Zurich, Switzerland.

HYDRO-ELECTRIC DEVELOPMENTS

QUEBEC. Hydro-Electric Power Developments on the Gatineau River, J. A. McCrory. Eng. Jl., vol. 10, no. 3, Mar. 1927, pp. 119-129, 12 figs. Important features of Farmers, Chelsea and Paugan power developments of Gatineau Power Co.

HYDRO-ELECTRIC PLANTS

EXCESS ENERGY. The Utilization of Excess Energy in Hydro-Electric Plants. AEG Progress, vol. 2, no. 12, Dec. 1926, pp. 361-369, 14 figs. Utilization of excess energy can be divided into internal and external utilization, under former being included means for increasing utilization of excess water available, and under latter, utilization of excess energy by consumers; storage of excess energy in accumulators; utilization as chemical energy; heat energy in melting and hardening furnaces, electric boilers, cooking and heating apparatus, etc.

ONTARIO. Electric Power for Ontario Mines, A. R. Webster. Can. Min. Jl., vol. 47, no 9, Mar. 4, 1927, pp. 184-188.

New Campbellford Station, Quinte and Trent Valley Power Co. Elec. News, vol. 36, no. 4, Feb. 15, 1927, pp. 25-26 and 44, 7 figs.

New Frankford Generating Station on Trent River. Elec. News, vol. 36, no. 5, Mar. 1. 1927, pp. 27-29, 7 figs.

PLANNING PROBLEMS. Planning Problems on Water Power Plants, S. Füllsack. AEG Progress, vol. 2, no. 12, Dec. 1926, pp. 320-323, 5 figs. Considers problems which lead to compromise in planning of mechanical portion of hydro-electric plants; comparison of German and American installations leads to conclusion that latter operate under less severe guarantees, and have smaller flywheel effects.

SWITZERLAND. The Waggital Hydro-Electric Works. Water & Water Eng., vol. 29, no. 338, Feb. 21, 1927, pp. 51-53, 4 figs. Includes creation of artificial lake, 1¾ sq. mi. in area, and capable of holding 4,950,000,000 cu. ft. of water, and construction of gigantic wall blocking entrance to valley, 590 ft. along crest, 317 ft. high and 246 ft. broad at base, equivalent to 8,100,000 cu. ft. of concrete; installation is purely winter power station (Nov. 1 to Mar. 31); maximum output is 160,000 h.p.

WATERTOWN, N.Y. Municipal Hydro Plant and Street-Lighting System, Watertown, N.Y., J. W. Ackerman. Am. City, vol. 36, no. 3, Mar. 1927, pp. 315-319, 6 figs.

I

INDUSTRIAL MANAGEMENT

AMERICAN METHODS IN EUROPE. American Management Methods Applied to Foreign Government Industries, W. Clark. Taylor Soc.—Bul., vol. 12, no. 1, Feb. 1927, pp. 307-311. Author describes his work for American Finance Commission to Poland.

COST, ACCOUNTING. *See Cost Accounting.*

INVENTORY CONTROL. Watch the Inventory Dollars, J. H. Rand, Jr. Factory, vol. 38, no. 3, Mar. 1927, pp. 449-452, 2 figs.

OVERHEAD COST. Some Central Problems of Overhead Costs, J. M. Clark. Taylor Soc.—Bul., vol. 12, no. 1, Feb. 1927, pp. 287-293. Questions of business policy, of accounting technique and of community efficiency.

PRODUCTION SCHEDULE. Seven Advantanges of Production Scheduling, J. F. Hennessey. Indus. Mgmt. (N.Y.), vol. 73, no. 2, Feb. 1927, pp. 93-95, 1 fig. Points out seven separate advantages accruing from production scheduling, as they could be made to apply to almost any industry; deals mainly with methods followed by General Electric Co., and explains in detail different forms used.

PURCHASING. A Centralized Purchasing System for the Medium-Sized Plant, R. C. Kelley. Factory, vol. 38, no. 3, Mar. 1927, pp. 479 and 608. Discusses following questions: (1) Can smaller plant adopt purchasing system of larger plant?; (2) should purchasing department control taking of inventory?; (3) where should material requisitions originate?; (4) how many records must purchasing department maintain?; (5) how much detail work can purchasing agent profitably do?

SMALL PLANTS. Management Methods in the Small Plant, H. P. Wherry. Mfg. Industries, vol. 13, nos. 1 and 2, Jan. and Feb. 1927, pp. 41-44 and 115-119, 10 figs. Jan.: Financial policies and methods of reorganizing accounting, cost and production operations, which produced substantial savings. Feb.: Results from reorganized financial and sales methods in small plant.

INDUSTRIAL MOBILIZATION

NATIONAL. National Industrial Mobilization, W. S. Lyhne. Iron Age, vol. 119, no. 10, Mar. 10, 1927, pp. 730-731, 1 fig. Co-ordination of government planning with manufacturing preparedness, designed to save lives, waste and confusion.

INDUSTRIAL PLANTS

LOCATION. Transportation Facilities in Plant Location, H. S. Colburn. Mfg. Industries, vol. 13, no. 2, Feb. 1927, pp. 135-139. Deals with railway, highway, electric and air transportation.

INSULATION, HEAT

PROTECTION AGAINST MOISTURE. The Protection of Insulation Against Moisture, C. H. Herter. Refrig. World, vol. 62, no. 3, Mar. 1927, pp. 7-10 and 32. Methods used in safeguarding cold-storage insulation against entrance of moisture.

INSULATION MATERIALS, HEAT

HEAT-LOSS MEASUREMENT. Improved Apparatus for Measuring Thermal Conductivity, A. L. Spafford. Ice & Refrigeration, vol. 72, no. 2, Feb. 1927, pp. 176-177, 2 figs. Improved instrument designed by J. C. Peebles for measuring heat loss through insulating tests made and manner of procedure.

INTERNAL-COMBUSTION ENGINES

DETONATION. Gaseous Explosions, G. G. Brown and G. B. Watkins. Ind. & Eng. Chem., vol. 19, no. 3, Mar. 1927, pp. 363-369. Rate of rise of pressure, velocity of flame travel and detonation wave; probable mechanism causing "detonation" in internal-combustion engine.

TESTING. New Engine-Testing Forms. Soc. Automotive Engrs.—Jl., vol. 20, no. 1, Jan. 1927, pp. 10-12. Proposed S.A.E. standard charts will be applicable to all internal-combustion engine types.

See also Airplane Engines; Automobile Engines; Oil Engines.

INVENTIONS

PATENTABLE. What Is a Patentable Invention? L. T. Parker. Machy. (N.Y.), vol. 33, no. 7, Mar. 1927, pp. 521-524. Nature of improvements that constitute invention; when old elements and simplified designs are patentable.

IRON ALLOYS

IRON-CHROMIUM-NICKEL. An Introduction to the Iron-Chromium-Nickel Alloys, E. C. Bain and W. E. Griffiths. Am. Inst. Min. & Met. Engrs.—Trans., no. 1650-C, Mar. 1927, 46 pp., 37 figs. Results of inquiry into structural nature of some 70 iron alloys containing both nickel and chromium over considerable range of concentration.

IRON, PIG

FOUNDRY. Need for Research in Foundry Pig Iron, R. Moldenke. Am. Inst. Min. & Met. Engrs.—Trans., no. 1648-C, for mtg. Feb. 1927, 5 pp. Conditions under which pig iron is melted; trend to-day is toward specification of total carbon content in pig iron; it seems that time has come for technical side of furnace development of country to be organized into associated effort, so that this industry may benefit in similar manner as has that of foundry.

L

LATHES

MULTIPLE TOOL. Automatic Multi-Cut Lathe. Machy. (Lond.), vol. 29, no. 749, Feb. 17, 1927, pp. 649-650, 3 figs. Made by Gebr. Heinemann A.G., St. Georgen; it is intended to use on both repetition work and small batches.

LIGHTING

DRAUGHTING ROOMS. Drawing-Office Lighting. Engineer, vol. 143, no. 3711, Feb. 25, 1927, pp. 205-206, 2 figs. By reason of important and special nature of work carried out in draughting rooms, illumination of character entirely different from that employed in commercial offices is required.

LIGHTING

SCIENCE CONTRIBUTIONS TO. Contributions of Science to the Lighting Art, M. Luckiesh. Illum. Eng. Soc.—Trans., vol. 22, no. 2, Feb. 1927, pp. 178-188. Scientific methods are being employed in actual tests of street lighting, of automobile headlamps, of production in facories as influenced by lighting, of relation of safety and lighting, and other phases of lighting, but they are handicapped by scanty knowledge and doubtful test methods as yet available. (Abstract.) Address before Am. Assn. for Advancement of Science.

LIGNITE

Southwestern States. Low-Grade Coals and Lignite for Fuel, C. W. Dabney. Mfrs'. Rec., vol. 91, no. 11, Mar. 17, 1927, pp. 77-78. Brings out points in connection with uses that are being made of low-grade coal and lignites as fuel, which opens up vast industrial possibilities for Southwest.

LIQUIDS

Boiling Point and Pressure. Boiling Points and Vapor Pressures, E. N. Jonson. Gas Age-Rec., vol. 59, no. 8, Feb. 19, 1927, pp. 259-360, 6 figs. Since there exists definite relationship between boiling point and pressure upon liquid, for any liquid, curves or tables can be arranged so that characteristics of liquid can be readily observed; such curves would be highly useful in regulating operation, determining most practical distillation temperature and pressure under given operating limits, as well as, in distillation of certain mixtures, what products might be expected.

LOCOMOTIVES

Coaling Stations. Reading Builds Unusual Coaling Station at Rutherford, Pa. Ry. Age, vol. 82, no. 7, Feb. 12, 1927, pp. 456-458, 4 figs. Mixing and measuring devices permit use of more economical fuel and measurements of all withdrawals.

Steam-Turbine. The Reid-MacLeod Steam-Turbine Locomotive. Engineer, vol. 143, no. 3708, Feb. 4, 1927, pp. 118-120, 12 figs. partly on p. 130 and supp. plate. In this British design, problem has been attacked in different way from that followed by other makers; arrangement consists of long girder frame on which boiler, condenser, etc., are mounted, and which is borne by two 8-wheeled trucks, on one of which is fitted high-pressure steam turbine and on other a low-pressure turbine; each of these turbines drives through reducing gear a short longitudinal countershaft, which is provided at each end with bevel pinion gearing with large bevel wheel on quill which drives axle passing through it.

LUBRICATING OILS

Viscosity and Adhesion. Theoretical and Practical Study of Lubrication (Etude théorique et pratique sur le graissage), H. Havre. Génie Civil, vol. 99, no. 2, Jan. 8, 1927, pp. 45-48, 9 figs. It is shown that lubricating value of oil is primarily function of its adhesiveness, which is result of electrostatic and chemical phenomena combined with phenomena of absorption; viscous oil of low adhesive quality is poor lubricant, whereas oil of low viscosity but with great adhesive capacity is excellent lubricant.

LUBRICATION

Cold Weather Requirements. Cold Weather Requirements as Pertaining to Lubrication, A. F. Brewer. Indus. Mgmt. (N.Y.), vol. 73, no. 2, Feb. 1927, pp. 101-105, 7 figs. Deals with lubrication of mechanical equipment in severe service or under extremely bad weather conditions; explains properties of different kinds of lubricants; points out effect of proper lubrication and its results, tending to reduce undue wear and possible mechanical delays or failures.

M

MACHINE SHOPS

Production Costs. Lower Costs Asked of the Foreman, A. Mumper. Iron Age, vol. 119, no. 10, Mar. 10, 1927, pp. 713-715. Stumbling blocks to cheaper production; study in quantity output at low cost per unit.

MACHINE TOOLS

Failures. Machine-Tool Failures—Their Causes and Avoidance, E. R. Stoddard. Soc. Automotive Engrs.—Jl., vol. 20, no. 3, Mar. 1927, pp. 385-388.

Replacement Policy. What Are the Reasons for Replacing Obsolete Equipment? Am. Mach., vol. 66, nos. 2, 4, 6, 8, Jan. 13, 27, Feb. 10 and 24, 1927, pp. 39-40, 157-158, 239-240 and 316-317. Jan. 13: Value of repair cost record. Jan. 27: How obsolete machines are disposed of. Feb. 10: Faults of machine tools. Feb. 24: How to keep informed of developments in equipment.

MAGNESIUM ALLOYS

Analysis. Methods of Analyzing Industrial Alloys of Magnesium (Méthodes d'analyse des alliages industriels de magnésium), E. Pretet and L. Ecoffet. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 459-470, 2 figs. Determination of silicon, iron, aluminum, copper, zinc, manganese, lead, cadmium, nickel, calcium, carbon, nitrogen, etc., in magnesium and magnesium alloys.

MANGANESE STEEL

Properties. Curious and Hitherto Unexplained Facts Concerning Manganese Steel (Quelques faits curieux et non encore expliqués observés dane l'acier au manganèse), R. Hadfield. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 136-139, 4 figs. Properties of manganese steel; effects of heat treatment on hardness and magnetic properties; photomicrographic examination.

MATERIALS HANDLING

Industrial Plants. Better Methods Cut Handling Costs 50%, E. L. Spray. Mfg. Industries, vol. 13, no. 2, Feb. 1927, pp. 101-106, 13 figs. Westinghouse plant also reduces direct labour costs 20% by new equipment and rearrangement of layout.

MEASURING INSTRUMENTS

Comparators. Société Genevoise Comparator for Small Internal Diameters. Am. Mach., vol. 66, no. 9, Mar. 3. 1927, pp. 389-390, 1 fig. Made by Société Genevoise d'Instruments de Physique of Geneva, Switzerland, for use in measuring internal diameters of small size.

MECHANICS

Wave. Matrix and Wave Mechanics, R. H. Fowler. Nature (Lond.), vol. 119, no. 2989, Feb. 12, 1927, pp. 239-241. Describes ideas of new mechanics and some of successes to which they have led; author endeavours to exhibit two independent lines of thought which have led separately to same new system of mechanics, but by such widely divergent paths that they have justifiably received different names of matrix and wave mechanics.

The Quantization of the Rotational Motion of the Polyatomic Molecule by the New Wave Mechanics, E. E. Witmer. Nat. Acad. of Sciences—Proc., vol. 13, no. 2, Feb. 1927, pp. 60-65. In previous article, author considered quantization of rotational motion by classical quantum theory; as this theory is being superseded by new wave mechanics, he treats same problem by new theory.

METAL SPRAYING

Processes. Metal Spraying, W. E. Ballard. Metal Industry (Lond.), vol. 30, no. 7, Feb. 18, 1927, pp. 191-192. Schoop process; early failures due to porosity; preparation of surface; sprayed zinc; aluminum coatings; lead and tin. Lecture before Birmingham Assn. Mech. Engrs.

METAL WORKING

Winding Strip Stock. Edgewise Winding of Metal Strip, H. A. Freeman. Machy. (N.Y.), vol. 33, no. 7, Mar. 1927, pp. 525-528, 8 figs.

METALLOGRAPHY

Microscopic Examination of Metals. The Technique of Examining Metals Under the Microscope. Gen. Elec. Rev., vol. 30, no. 3, Mar. 1927, pp. 160-166, 16 figs. Microscopic and photographic optics.

METALS

Corrosion. Controllable Variables in the Quantitative Study of the Submerged Corrosion of Metals, O. B. J. Fraser, D. E. Ackerman and J. W. Sands. Ind. & Eng. Chem., vol. 19, no. 3, Mar. 1927, pp. 332-338, 9 figs. Great influence of controllable variables on results of laboratory corrosion tests of total-immersion type is discussed and illustrated by numerous data obtained in study of action of sulphuric-acid solutions on monel metal.

Elastic Properties. Study of Elastic Properties and Viscosity of Metals and Alloys (Contribution a l'étude des propriétés élastiques et de la viscosité des métaux et alliages), P. Chevenard and A. Portevin. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 434-448, 35 figs. Methods and apparatus for study of elasticity; modulus of elasticity and internal friction as function of initial state and of testing temperature; influence of quenching; study of viscosity of alloys.

METHANOL

Water Gas as Source. Use of Off-Peak Water-Gas Capacity for Methanol Production, A. C. Fieldner. Am. Gas Jl., vol. 126, no. 8, Feb. 19, 1927, pp. 179-181 and 18. Description and present status of process.

MINE HAULAGE

Rope. Underground Rope Haulages and Their Design, F. Beckett. Indus. Mgmt. (Lond.), vol. 14, no. 3, Mar. 1927, pp. 82-86, 6 figs. Reviews progress in design of haulage machinery from earliest days of mining up to present day and then deals more fully with present-day design.

MINE HOISTING

Rope. Acceleration Stresses in Wire Hoisting Ropes, G. P. Bloomsliter. Am. Inst. Min. & Met. Engrs.—Trans., no. 1641-A, Feb. 1927, 20 pp., 11 figs. Discussion based on assumption of constant acceleration at drum; mathematical work is based upon assumption that top is moving upward with constant acceleration, and ignores fact that cable is shortening as it winds.

MINES

Electrical Equipment. Novel Improvements in Electric Equipment in Lake Superior District, E. Gealy. Eng. & Min. Jl., vol. 123, no. 9, Feb. 26, 1927, pp. 367-379, 6 figs. Operating conditions call for unusual sturdiness; use of d.c. shovels increasing; automatic power control of ore cars on stockpiles and in pits.

Ventilation. Metal Mine Ventilation. Min. & Met., vol. 8, no. 243, Mar. 1927, pp. 124-125. Discussion of paper by J. I. Smith on use and danger of auxiliary fans.

MINING INDUSTRY

British Columbia. Notes on the Mining Industry in Slocan District, B.C., C. E. Cairnes. Can. Min. & Met. Bul., no. 178, Feb. 1927, pp. 179-199 and (discussion) 199-200, 9 figs. History and mining progress; geology and mineral deposits.

MOULDING METHODS

Hollow Cylinders. How to Make a Mould for a Long Hollow Cylinder. Foundry, vol. 55, no. 5, Mar. 1, 1927, pp. 174-176, 2 figs. Several alternative methods suggested; local conditions affect final choice; loam and dry sand compared as moulding medium.

MOULDS

Drying. Dries Moulds Electrically, F. C. Taylor. Foundry, vol. 55, no. 5, Mar. 1, 1927, pp. 167-168, 2 figs. Results of investigation conducted by Gleason Works, Rochester, N.Y., to determine best method for drying moulds; company found electricity exceedingly satisfactory for this purpose.

MORTARS

Sand-Lime, Hardening. Effects of Chloride and Metallic Sulphates on Hardening of Sand-Lime Mortars, F. Justin-Mueller. Rock Products, vol. 30, no. 3, Feb. 5, 1927, p. 79. Comparison of sand-lime mixtures containing added proportions of chloride and metallic sulphates; effects of atmosphere on various sand-lime mixtures containing varying proportions of chloride and sulphates. Translated from Chemiker Zeitung.

MOTOR TRUCKS

Producer-Gas. Producer-Gas Trucks (Les camions a Gazogène), G. Delanghe. Génie Civil, vol. 90, no. 1, Jan. 1, 1927, pp. 1-13, 29 figs. Considerations and descriptions of principal French types. Technical point of view; process of cleaning gas; operation of trucks. Economic viewpoint; calculation of economy to be derived by replacing alcohol with producer-gas.

Fuels for Producer-Gas Trucks (Combustibles à employer sur les camions à gazogène), P. Dumanois. Société d'Encouragement pour l'Industrie Nationale—Bul., vol. 125, no. 12, Dec. 1926, pp. 912-913. See brief translated abstract in Mech. Eng., vol. 49, no. 4, Apr. 1927.

O

OIL ENGINES

Light-Weight. Light-Weight Oil Engines, F. Johnstone-Taylor. Gas & Oil Power, vol. 22, no. 258, Mar. 3, 1927, pp. 119-121, 5 figs. European and American progress in design.

OIL FUEL

Burners. Laidlaw and Drew Oil Fuel Burners. Engineering, vol. 123, no. 3186, Feb. 4, 1927, pp. 151-153, 11 figs. These burners are outcome of long series of trials and experiments made in connection with production of internal-combustion boiler, for which it was necessary to design burner capable of giving flame that would burn in enclosed space under considerable pressure; means for controlling shape of flame produced were devised.

OPEN-HEARTH FURNACES

End Ports. Open-Hearth End Ports, B. Finney. Iron Age, vol. 119, no. 10, Mar. 10, 1927, p. 715, 2 figs. By deviation from standard practice in construction, basic open-hearth steel furnace at Lima, O., plant has been enabled to produce four 25-ton heats in 24 hrs.; this oil-burning furnace has three instead of customary uptakes.

ORE DRESSINGS

Stratification. The Theory of Stratification and Its Application in Ore-Dressing, B. M. Bird. Min. & Met., vol. 8, no. 243, Mar. 1927, pp. 144-145, 3 figs. Discussion of paper by A. W. Fahrenwald points out that concentrator makes final product, classifier prepares material for subsequent operation; varying type of stratification in successive treatments is sound practice.

ORE TREATMENT

Concentration. Resistance to Wear a Basis for Concentrating Ores, A. M. Gaudin. Eng. & Min. Jl., vol. 123, no. 6, Feb. 5, 1927, pp. 245-246, 1 fig. Relative hardness and brittleness of certain non-metallic minerals may be utilized in their separation.

OXY-ACETYLENE WELDING

Pipe Lines. Pipe Line Welding from the Oxy-Acetylene Viewpoint, L. Edwards. Am. Welding Soc.—Jl., vol. 6, no. 2, Feb. 1927, pp. 7-24, 18 figs. Advantages; notes on preparation, material, aligning of pipe, methods of laying pipe, testing of line, expansion and contraction, etc.

Steel Plate. Oxy-Acetylene Welding Steel Plate, T. C. Fetherston. Am. Welding Soc.—Jl., vol. 6, no. 2, Feb. 1927, pp. 25-30, 4 figs. Two major factors of importance are fusion and penetration.

P

PIGMENTS

Titanium. Manufacture and Uses of Titanium Pigment, R. H. Monk. Can. Chem. & Met., vol. 11, no. 3, Mar. 1927, pp. 69-70. Process of extracting titanium from ilmenite; properties and uses of titanium.

PLANERS

Electric Drive. A Large Electrically-Driven Planing Machine. Engineer, vol. 143, no. 3710, Feb. 18, 1927, pp. 190-193, 6 figs. Made by J. Stirk & Sons, Halifax; weighs 75 tons and can plane faces of block 10 ft. wide, 8 ft. high and 20 ft. long.

PORCELAIN

Annealing. Annealing Porcelain Parts, R. A. Weaver. Can. Foundryman, vol. 18, no. 2, Feb. 1927, p. 13. Problem of continuous processes confronting enameler of porcelain.

POTASH

Production, 1925. Potash in 1925, A. T. Coons. U. S. Bur. Mines—Mineral Resources, II:22, Jan. 29, 1927, 9 pp. Production and sales; producing localities; imports and exports; consumption; market conditions; summary of world's production.

PROSPECTING

Electrical. The Problem of Electric Prospecting, T. Zuschlag. Eng. & Min. Jl., vol. 123, no. 8, Feb. 19, 1927, pp. 327-329, 1 fig. Author has developed magnetometer, feature of which is electric compensation of such unavoidable instrument variations as are caused by temperature changes and accidental shocks; this device makes magnetometer especially adapted for locating extremely weak magnetic field variations; methods for determining correct values of potential, intensity and phase angle, employing one exploring rod, and for investigation of magnetic groundfields employing one or two exploring coils; outstanding features of new methods are application of alternating field principles and of most sensitive measuring arrangements, patents for which have been applied.

Theories of Electrical Prospecting Methods, K. Sundberg. Min. & Met., vol. 8, no. 243, Mar. 1927, pp. 147-148, 2 figs. Formulas for strength as well as phase of alternating electric field and electromagnetic field, together with results of field measurements.

PULVERIZED COAL

Pulverizers. A Coal Pulverizing Machine. Engineer, vol. 143, no. 3712, Mar. 4, 1927, p. 249, 2 figs. Machine comprises series of beater arms hinged to disks on rapidly rotating shaft; interior of casing in which beaters rotate is in parts, formed of serrated cast-steel segments, and coal, fed in at top, is thrown violently against these serrations by action of beaters and is thoroughly pulverized.

PUMPING STATIONS

Ottawa. Municipal Pumping Plants at Ottawa, W. E. Macdonald. Can. Engr., vol. 52, no. 8, Feb. 22, 1927, pp. 229-230, 3 figs. One plant built in 1872 has capacity of 26,000,000 g.p.d., while Lemieux Island plant has capacity of 20,000,000 gal.; two 51-in. steel pipes convey water from island to city; high-pressure system.

PUMPS

Oscillating-Piston. The Corma Oscillating-Piston Pump. Engineering, vol. 123, no. 3184, Jan. 21, 1927, pp. 74-75, 7 figs. New pump which is essentially of reciprocating type, but possesses advantages over normal plunger pump that it is more compact and has rotary drive, has been put on market by Belgium concern.

PUMPS, CENTRIFUGAL

Self-Starting. New Types of Self-Starting Centrifugal Pumps, F. Neumann. Eng. Progress, vol. 8, no. 2, Feb. 1927, pp. 47-50, 11 figs. Requirements to be fulfilled by centrifugal pumps; modern types; fire pumps; saving in space and weight as compared with piston pumps.

R

RADIOTELEPHONY

Reception. The Correlation of Radio Reception with Solar Activity and Terrestrial Magnetism, G. W. Pickard. Inst. Radio Engrs.—Proc., vol. 15, no. 2, Feb. 1927, pp. 83-97, 6 figs. Emphasizes importance of systematic long-period observations of radio reception; results so far obtained in correlation between radio reception, solar activity and magnetic disturbances.

RAILWAY MOTOR CARS

Gasoline-Electric. Double Power Plant Motor Cars on the Lehigh Valley. Ry. Mech. Engr., vol. 101, no. 2, Feb. 1927, pp. 89-92, 6 figs. Four Brill 500-h.p. units handle maximum trains of over 300 tons in local service; each motor car carries two power plants, each consisting of 250-h.p. Brill-Westinghouse gasoline engine direct-connected to Westinghouse 160kw. generator.

Two Gas-Electric Cars Put in Service on D. T. & I. Ry. Age, vol. 82, no. 9, Feb. 26, 1927, pp. 563-564, 5 figs. Each car displaces passenger train making daily run of 280 mi. in regular service.

RAILWAY OPERATION

Economics. Report of Committee XXI—Economics of Railway Operation. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 293, Jan. 1927, pp. 471-556, 13 figs. Methods of analyzing costs for solution of special problems; methods of operation by which intensive use of facilities may be secured; development of suitable units for costs of operation and equipment maintenance; study of problem of branch-line operation as affected by introduction of motor trucks and bus lines.

RAILWAY SWITCHES

Spring. Spring Switches Used Extensively on Chicago & North Western, J. A. Peabody. Ry. Signaling, vol. 20, no. 3, Mar. 1927, pp. 97-101, 14 figs. Also Ry. Age, vol. 82, no. 10, Mar. 5, 1927, pp. 639-642, 10 figs. Seventeen installations on eight different kinds of layout with special signal protection, latest-type buffers and rods used.

RAILWAY TIES

Preservative Treating. Substantial Economies Obtained by Use of Treated Timber, C. A. Smith. Elec. Ry. Jl., vol. 69, no. 11, Mar. 12, 1927, pp. 455-457, 8 figs. Georgia Ry. & Power Co. has reduced cost of ties by $1,188 per year per mile of track; prior to installation, all timber preservatives treatment by Rueping process.

Specifications. Railroad Tie Specification and Tie Treatment, W. F. Goltra. Eng. News-Rec., vol. 98, no. 8, Feb. 24, 1927, pp. 309-310, 1 fig. New classification of ties by size and area is proposed; needless to group ties by species for treatment.

Report of Committee III—Ties. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 292, Dec. 1926, pp. 189-206, 4 figs. Recommendations for future work; substitute ties—reports from railways making tests; anti-splitting devices; renewal of switch ties out of face vs. individuality.

RAILWAY TRACK

Concrete Roadbed. Building Concrete Roadbed for the Pere Marquette R. R. Eng. News-Rec., vol. 98, no. 8, Feb. 24, 1927, pp. 312-313, 4 figs. Heavy slab has steel truss reinforcement under rails; gravel concrete mix; construction methods.

Economics. Economics of Railway Track, J. M. Farrin. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 291, Nov. 1926, pp. 177-187, 14 figs.

Specifications. Report of Committee V—Track. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 292, Dec. 1926, pp. 177-188, 13 figs. Revision of manual; plans of switches, frogs, crossings and slip switches; specifications and designs for foundations under crossings.

RAILWAYS

Depreciation. Depreciation—A Much Confused Term, H. E. Riggs. Ry. Age, vol. 82, no. 7, Feb. 12, 1927, pp. 465-468. There must be complete revision of ideas on this subject of depreciation; new units must be determined; standards of maintenance must be studied and costs of keeping up to those standards found; correct analysis and determination of depreciation must give weight to accounting records.

Industrial. Industrial Railways for Factory and Construction Work, E. E. R. Tratman. Eng. News-Rec., vol. 98, nos. 9 and 10, Mar. 3 and 10, 1927, pp. 356-359, 402-405, 16 figs. Standard and narrow-gauge trackage for mills, warehouses and manufacturing plants; track layout and equipment; greater uniformity of gauge desirable; construction tracks. Mar. 10: Examples of practice at mills and industrial plants of different kinds; opinions of engineers and contractors on construction work; standard, narrow and mixed gauges.

Location. Report of Committee XVI—Economics of Railway Location. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 294, Feb. 1927, pp. 785-831, 16 figs. Economics as affected by introduction of electric locomotives; relative merits of 0.4 per cent ruling grade as compared with 0.3 per cent grade; relative merits of increasing tonnage by reduction of ruling grades, or by introduction of more powerful locomotives.

Standardization. Report of Special Committee on Standardization. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 291, Nov. 1926, pp. 145-175. American Engineering Standards Committee, its official organization, cost and operation; policy of procedure concerning "recommended practices"; gives list of engineering and industrial standards officially approved by Committee.

REDUCTION GEARS

Design. Notes on Reduction Gear, W. J. Guthrie. Inst. Mar. Engrs.—Trans., vol. 38, Jan. 1927, pp. 415-440 and (discussion) 441-463, 19 figs. Deals with mechanical or toothed gearing; gearing efficiencies and design; factors influencing smooth running without noise; lubrication; gear cutting; pitting and fracture of teeth; metallurgical problems; specification of gear pinions.

REFRIGERATING MACHINES

Carbon-Dioxide. CO_2 Liquid Pre-Cooling, E. H. Lamb. Ice & Cold Storage, vol. 30, nos. 347 and 348, Feb. and Mar. 1927, pp. 35-37 and 59-62, 12 figs.

REFRIGERATING PLANTS

Performance Determination. Finding the Performance of an Ammonia Refrigerating Plant, A. T. Nicholas. Power, vol. 65, no. 10, Mar. 8, 1927, pp. 368-369, 3 figs. Use of temperature-entropy graph of ammonia cycle permits simple method of determining performance of unit if conditions of operation are known.

REFUSE DISPOSAL

Power Production from Refuse. The Production of Power from Town's Refuse, J. W. Reber and A. Scott. Chem. & Industry, vol. 46, no. 6, Feb. 11, 1927, pp. 119-123, 2 figs. Nature of refuse; collection and disposal; separation for salvage and incineration without separation; partial separation and incineration; calorific value of refuse; mechanical and chemical analysis; evolution in design of destructors.

REGULATORS

Steam-Pressure. Steam-Pressure Regulator for Heat-Extraction Engines. Engineerinfi, vol. 123, no. 3184, Jan. 21, 1927, p. 76, 4 figs. on p. 78. Automatic regulator for maintaining constant steam pressure on extraction mains, whatever load on engines may be; they are attached to compound extraction engines, each of 600 i.h.p.

RESERVOIRS

Impounding. The Biological Control of Impounding Reservoirs, C. Wilson. Am. Water Works Assn.—Jl., vol. 17, no. 2, Feb. 1927, pp. 247-252. Points out that careful study of biological factors affecting water under storage will undoubtedly show many new ways of improving water.

RIVERS

Silt and Scour Theories. A Theory of Silt and Scour, W. M. Griffith. Engineering, vol. 123, no. 3184, Jan. 21, 1927, p. 72. Points out that power of stream to transport silt in suspension is derived from vertical eddies; it is shown that if weir is too wide, the greater the flood the greater is shoaling; and if too narrow, the greater the flood the greater is scour; it is argued from this that there is some width of weir for which action of scour and shoaling under high and low floods will be minimum, and that this width can be calculated. (Abstract.) Paper read before Instn. Civ. Engrs.

ROAD CONSTRUCTION

Alignment and Grades. Alignment and Grades of County Roads, W. J. Moore. Can. Engr., vol. 52, no. 9, Mar. 1, 1927, pp. 247-248, 4 figs. Increase of motor traffic calls for better alignment and easier grades; roads should have minimum width of 24 ft.

History of Progress. Two Thousand Years of Road Building, T. H. MacDonald. Mun. & County Eng., vol. 72, no. 1, Jan. 1927, pp. 46-51. Review of three great programmes of highway building within recorded history that by major tests of area served and mileage completed may be classed together; that of Roman Empire beginning with Julius Caesar and extending to Constantine; that of France under Emperor Napoleon; and that of United States during past decade. Paper read before Am. Assn. State Highway Officials.

Landslides. Handling Landslides on Mountain Roads, H. J. Spelman. Eng. News-Rec., vol. 98, no. 11, Mar. 17, 1927, pp. 434-438, 7 figs. Landslides as classified in three ways, with reference to their effect upon roadway; those which fill up roadway, those which heave roadway and those which cause roadway to drop; among methods successfully used have been sinking of well casing into underlying solid strata, driving of wooden piling, use of sheet piling, constructing retaining walls, drainage ditches, diversion of water courses, loading of toe of slide with rock, etc.

Mineral Aggregates. Mineral Aggregates for Highway Construction, A. S. Rea. Nat. Sand & Gravel Bul., vol. 8, no. 2, Feb. 15, 1927, pp. 52-54. Expression on various grades and classes of mineral aggregates used in highway construction, with reference to types of construction in which they are used.

Modern Practice. Construction of Modern Roads for Automobile Traffic, W. Reiner. Eng. Progress, vol. 8, no. 2, Feb. 1927, pp. 29-33, 9 figs. Restrictions on weight and width of heavy motor trucks for road-building purposes and on account of costs of maintenance; requirements as to layout of highways, curves, profile; different kinds of surfaces for roads with automobile traffic, taking into consideration experiences made in Germany during recent years.

Problems. Ontario Road Construction Conference. Can. Engr., vol. 52, no. 9, Mar. 1, 1927, pp. 249-250. Outstanding features of annual meeting of County and Township Engineers and Road Superintendents in Toronto; papers covering various phases of road construction and maintenance.

ROAD MATERIALS

Control. Control of Highway Materials and Results, H. S. Mattimore. Mun. & County Eng., vol. 72, no. 1, Jan. 1927, pp. 13-16. Comparison of aggregates; water-cement ratio design; slab strength of surfacing; differential in final pavement. Paper read before Am. Road Bldrs'. Assn. See also Roads & Streets, vol. 67, no. 2, Feb. 1927, pp. 91-92.

ROADS

Maintenance. Organizing Work on Township Roads, W. M. Abraham. Can. Engr., vol. 52, no. 9, Mar. 1, 1927, pp. 250-252. Duties of superintendent and difficulties in way of township-road improvement; selection of men for continuous service; road construction and maintenance. Paper presented at Conference on Road Construction, Toronto.

Subgrade Soil. Progress in Subgrade Soil Investigations, F. H. Eno. Roads & Streets, vol. 67, no. 2, Feb. 1927, pp. 82-88. What is being done in laboratory research and in field. Paper presented before Am. Road Bldrs'. Assn.

ROADS, CONCRETE

Design. Some Details of Concrete Road Construction, H. V. Overfield. Surveyor, vol. 71, no. 1830, Feb. 18, 1927, p. 225. Deals with thickness of slab, methods of laying, alternate-bay method, supports for joints, induration, etc.

Concrete Highways, H. F. MacWilliams. Boston Soc. Civ. Engrs.—Jl., vol. 14, no. 2, Feb. 1927, pp. 143-146. Foundation and slab design; drainage of foundation; proportioning of aggregates; screening; construction of transverse joints.

Paving Slab. Four-Lane Flexible Paving Slab for Concrete Streets, F. M. Balsley. Eng. News-Rec., vol. 98, no. 9, Mar. 3, 1927, p. 361, 2 figs. All joints doweled, but no reinforcement was employed; subdivision of slab depended on to eliminate cracking.

ROADS, MACADAM

Mixed Macadam. Mixed Macadam Pavement, R. M. Smith. Mun. & County Eng., vol. 72, no. 1, Jan. 1927, pp. 23-25. History of mixed macadam followed as result of study of construction of bituminous penetration surface; method of construction. Paper read before Fifth Asphalt Paving Conference.

ROLLING MILLS

Bar Mills. Mill to Roll Bars. Rods and Strip, F. L. Prentiss. Iron Age, vol. 119, no. 11, Mar. 17, 1927, pp. 779-783, 8 figs. Continuous sheet-bar mill run by 9,000-h.p. motor; flexibility is outstanding feature of new 10-in. merchant mill of Corrigan, McKinney Steel Co., Cleveland.

Cold Strip. Coilers for Cold Strip Rolling Mills, C. E. Davies. Engineer, vol. 143, nos. 3707 and 3708, Jan. 28 and Feb. 4, 1927, pp. 92-94 and 123-125, 21 figs.

S

SAND MOULDING

Mechanical Handling. Steel Foundry Handles Sand Mechanically, B. Welser. Foundry, vol. 55, no. 4, Feb. 15, 1927, pp. 126-128, 5 figs. Wisconsin casting plant employs special installation to clean, cool, aerate and temper large quantities of moulding sand.

SEWAGE DISPOSAL

Activated Sludge. Activated Sludge Process of Sewage Treatment, W. C. Roberts. Water Works, vol. 66, no. 1, Jan. 1927, pp. 14-16. Usual design of plant; aeration tanks; fine screens; mechanical aerator; disposal of sludge; activate sludge plants for preliminary treatment; operating and maintenance costs; advantages.

Methods. Modern Methods of Sewage Disposal, W. Butler and J. H. Coste. Chem. & Industry, vol. 46, no. 6, Feb. 11, 1927, pp. 49T-56T and (discussion) 56T-59T. Limitation of process of sedimentation; intensive biological treatment of sewage; types of plant for treatment with activate sludge; experiments on treatment.

Sludge Digestion. Sludge Digestion—Reaction and Control, G. M. Fair and C. L. Carlson. Boston Soc. Civ. Engrs.—Jl., vol. 14, no. 2, Feb. 1927, pp. 82-112 and (discussion) 112-130, 10 figs. Discusses changes in reaction that take place during progress of sludge digestion and their apparent relation to digestion activity; also shows effect of reaction adjustment by means of certain alkaline substances upon rate of digestion.

Treatment. Method of Sewage Treatment Adopted for North Toronto, A. L. Fales. Boston Soc. Civ. Engrs.—Jl., vol. 14, no. 2, Feb. 1927, pp. 75-81, 2 figs. In view of local conditions, high degree of purification is required, including not only efficient removal of suspended solids, but also fairly complete oxidation of dissolved organic matter in sewage; plant recommended, in addition to storm water stand-by tanks, will consist of racks, grit chambers, preliminary sedimentation tanks, activated sludge aeration and sedimentation tanks, covered separate sludge digestion tanks with provision for controlling reaction of sludge and glass-housed sludge beds.

SHAFT SINKING

Gold Mines, Ontario. Sinking of the McIntyre Shaft, E. D. Loney. Can. Min. Jl., vol. 47, no. 9, Mar. 4, 1927, pp. 189-190. Working 692 days with average of 17 men per shift, passed 4,000-ft. objective; excavated 180,000 tons of rock in operation.

SHAFTS

Flexible. Strength and Elasticity of Flexible Shafts, T. M. Naylor. Machy. (Lond.), vol. 29, no. 750, Feb. 24, 1927, pp. 665-667, 5 figs. Results of tests carried out at Leeds University; object was to find safe twisting moment that shaft could withstand, and also to obtain total twist of shafts; various lengths of shafts were tested, and tests were made in both clockwise and anti-clockwise directions.

SMOKE

Abatement. Chicago's Smoke Prevention Division, H. M. Bundesen and F. A. Chambers. Combustion, vol. 16, no. 2, Feb. 1927, pp. 96-99, 2 figs. Smoke problem confronting city of Chicago involves observation of chimneys of approximately 400,000 single- and two-family dwellings and over 55,000 apartment buildings, power plants, locomotives, marine craft and industrial furnace stacks, consuming over 30,000,000 tons of bituminous coal annually.

SNOW REMOVAL

Mountain Railways. Fighting Snow on a Mountain Railway in Norway, R. Lorange. Eng. News-Rec., vol. 98, no. 8, Feb. 24, 1926, pp. 318-321, 8 figs. Permanent high snow screens used to divert snow from track or to cause prevailing winds to blow track clear; snowsheds built to withstand great snow loads.

SOOT BLOWERS

Practice. Modern Soot-Blower Practice, R. June. Power, vol. 65, no. 9, Mar. 1, 1927, pp. 332-334, 5 figs. Marked changes in operating practice with respect to such important auxiliaries as mechanical soot blowers; steam economy improved; pressure-reducing orifices; continuous rotation saves steam; automatic stop; electrically-driven blowers.

SPEED REDUCERS

Industrial Machinery. Various Types of Speed Reducers for Industrial Machinery. Can. Min. Jl., vol. 47, no. 8, Feb. 25, 1927, pp. 160-161.

STEAM

High-Pressure. Recent Experiments on the Properties of Steam at High Pressures, H. L. Callendar. Roy. Soc. of Arts—Jl., vol. 75, nos. 3871 and 3872, Jan. 28 and Feb. 4, 1927, pp. 265-276 and 285-299, 12 figs. Joule and Thomson equation; correction for heat loss; progressive throttling; account of arrangements adopted for procuring steady flow of steam at high pressures; electric boilers; continuous condenser method of measuring total heat of steam at high pressures; application to turbine.

STEAM POWER

Tropical Ocean. Steam Power from the Ocean in the Tropics. Power, vol. 65, no. 9, Mar. 1, 1927, pp. 328-330, 1 fig. Analysis of proposition for production of power from ocean water in tropics developed by G. Claude and P. Boucherot.

STEAM POWER PLANTS

Combined Heating and Power. Economic Advantages of Combined Power and Heating Services (Les avantages economiques de la production combinée de la vapeur pour la force motrice et pour le chauffage), V. Reniger. Génie Civil, vol. 90, no. 4, Jan. 22, 1927, pp. 102-104, 1 fig. See brief translated abstract in Power Engr., vol. 22, no. 252, Mar. 1927, p. 114.

High-Pressure. Design of High-Pressure Industrial Power Plants, R. S. Bayntun. Engrs'. Soc. West. Penn.—Proc., vol. 42, no. 9, Dec. 1926, pp. 425-441. Describes new power plant of Chesapeake Corp.

Meat-Packing Industry. Production and Use of Power in the Packing Industry, C. H. Kane. Power, vol. 65, no. 10, Mar. 8, 1927, pp. 354-355.

STEAM TURBINES

Hot Liquids, Energy from. Industrial Utilization of the Energy of Hot Liquid in a Steam Turbine (Utilisation industrielle de l'énergie d'un liquide chaud dans une turbine à vapeur), J. Rey. Académie des Sciences—Comptes Rendus, vol. 183, no. 23, Dec. 6, 1926, pp. 1095-1096.

Impulse. Test Corrections for Impulse Steam Turbines, R. Livingstone. S. African Inst. Elec. Engrs.—Trans., vol. 17, Dec. 1926, pp. 276-290 and (discussion) 290-293, 16 figs.

Inspection. Forestalling Trouble by an Annual Inspection of Steam Turbines. Power, vol. 65, no. 11, Mar. 15, 1927, pp. 401-403, 4 figs. Coupling alignment and wear; axial and radial clearance; adjustment of reaction machines; blading defects; cleaning oil system and bearings; adjusting governing mechanism; valve and shaft packing.

Operation. New Practical Method for Operation of Turbines and Their Condensers (Nouvelle méthode industrielle pratique pour l'exploitation rationelle des turbines et de leurs condenseurs), H. Carra and R. Fric. Chaleur & Industrie, vol. 7, nos. 79 and 80, Nov. and Dec. 1926, pp. 629-635 and 697-704 and vol. 8, no. 81, Jan. 1927, pp. 29-38, 21 figs. Control of leakage and of pollution of condensed water; results of tests of Sulzer turbine of 2,000 kw.; temperature of cooling water and of condensed water; concludes that control of condensers should be continuous and simple.

STEEL

Alloy. *See Alloy Steels.*

Austenitic Structure. The Decomposition of the Austenitic Structure in Steels, O. E. Harder and R. L. Dowdell. Am. Soc. Steel Treating—Trans., vol. 11, no. 3, Mar. 1927, pp. 391-397, 12 figs. Continuation of research, paying particular attention to decomposition of austenite in liquid oxygen; six steels were included in investigation: (1) cobalt-chromium magnet steel; (2) Hadfield manganese steel; (3) high-carbon high-chromium steel; (4) high-speed steel; (5) 22 per cent nickel steel, and (6) hypereutectoid carbon steel; marked difference in stability of austenitic structure at low temperature is clearly shown; influence of stresses at liquid-oxygen temperature on decomposition of austenite.

Brittleness. Influence of Compression on the Brittleness of Steel (Influence de la compression sur la fragilité de l'acier), P. Dejean. Académie des Sciences—Comptes Rendus, vol. 184, no. 4, Jan. 24, 1927, pp. 188-189. Results of number of tests on bars with square section of 32 mm. on side forged from same billet and with same carbon content (0.80).

Cementation. Cementation of Mild Steel (Cémentation de l'acier doux par le cyanogène et la cyanamide), E. Perot. Académie des Sciences—Comptes Rendues, vol. 183, no. 23, Dec. 6, 1926, pp. 1108-1110, 2 figs. Use of cyanogen and of cyanamide for cementite formation as compared with ethylene and methane; cyanogen without renewing atmosphere gives results about equivalent to those obtained with ethylene or methane in continuous circulation.

Cementite Condition. The Importance of Cementite, R. G. Guthrie. Am. Soc. Steel Treating—Trans., vol. 11, no. 3, Mar. 1927, pp. 341-354, 17 figs. Author calls especial attention to what he believes to be basic and well-known points of vital importance when anticipating behaviour of articles manufactured from straight carbon steel.

Chromium. *See Chromium Steel.*

Corrosion Fatigue. Corrosion Fatigue of Metals as Affected by Chemical Composition, Heat Treatment and Cold Working, D. J. McAdam, Jr. Am. Soc. Steel Treating—Trans., vol. 11, no. 3, Mar. 1927, pp. 355-380 and (discussion), 380-390, 12 figs. Gives results of previous investigation, and sets forth materials, machines and specimens used in further investigation.

Embrittlement. Embrittlement of Steel, A. G. Christie. Am. Water Works Assn. —Jl., vol. 17, no. 2, Feb. 1927, pp. 174-189. Progress report of subcommittee No. 6 on embrittlement of metals.

Engine-Valve. Valve Steels, P. B. Henshaw. Roy. Aeronautical Soc.—Jl., vol. 31, no. 195, Mar. 1927, pp. 187-210 and (discussion) 211-217, 20 figs. Considers properties of valve steels in general use.

Fatigue Strength. Fatigue Strength of Hard Steels and Their Relation to Tensile Strength, J. M. Lessells. Am. Soc. Steel Treating—Trans., vol. 11, no. 3, Mar. 1927, pp. 1413-1420 and (discussion) 1421-1424, 10 figs. Data on tensile and fatigue properties of very hard steels.

Fractures. Interpretation of Steel Fractures, Priestley. Indus. Chemist, vol. 3, no. 25, Feb. 1927, pp. 63-66, 5 figs. To insure correct interpretation of any fracture, it is necessary to study causes of defects and failures in metals.

Manganese. *See Manganese Steel.*

Molybdenum in. Molybdenum in Steel. Iron & Coal Trades Rev., vol. 114, no. 3077, Feb. 18, 1927, p. 279. Review of report issued by Research Department, Woolwich, on influence of molybdenum on medium-carbon steels containing nickel and chromium.

Nickel and Cobalt in. A Comparison of the Effect of Nickel and Cobalt in Steel, F. H. Allison, Jr. Am. Inst. Min. & Met. Engrs.—Trans., no. 1662-C, Mar. 1927, 11 pp., 12 figs.

Nitration. Nitration in Steels (Sur la nitruration des aciers), L. Guillet. Académie des Sciences—Comptes Rendus, vol. 183, no. 21, Nov. 22, 1926, pp. 933-935. Brinell tests have been carried out on tempered case-hardened steel, and on chrome-aluminum steel which had been nitrated by means of ammonia for 90 hrs. at 510 deg. so as to produce nitrated layer 0.8 mm. thick; latter steel had greater initial hardness, and this was retained to greater extent than in cases of former, when steels were maintained at gradually increasing temperatures, (from 180 to 600 deg.), for various periods of time.

Stress Distribution. Stress Distribution in Mild Steel as Indicated by Special Etching, J. D. Jevons. Engineering, vol. 123, nos. 3187 and 3189, Feb. 11 and 25, 1927, pp. 155-157 and 221-223, 41 figs. partly on supp. plate.

Temper Brittleness. Temper Brittleness. Metallurgist, (Supp. to Engineer), Feb. 25, 1927, pp. 21-23, 2 figs. For steels which show temper brittleness there is temperature range in which, starting either from tough or brittle condition, tempering produces intermediate notched-bar impact value corresponding to equilibrium condition; tempering above this range always produces tough condition and below it causes no change.

STEEL CASTINGS

Gas Solubility in. Solubility of Gases in Cast Steel (Recherches sur la solubilité des gaz dans l'acier fondu), P. Dejean. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 427-429, 3 figs. Results of investigation to determine influence of nature of gases on formation of blowholes.

Risers, Removal of. The Removal of Risers in the Steel Foundry, L. E. Everett. Am. Welding Soc.—Jl., vol. 6, no. 1, Jan. 1927, pp. 48-56. Methods of removing risers used in modern progressive steel foundries; discusses four methods of removing heads: (1) by flogging or sledging; (2) by sprue cutter; (3) by cold saw (high or low speed); (4) by oxy-acetylene cutting torch; deals particularly with last method.

STEEL, HEAT TREATMENT OF

Hardening. Influence of Temperature of Quenching on Mechanical Properties of Special Low-Carbon Steels (Influence de la température de trempe sur les propriétés méchaniques d'aciers spéciaux peu carburés), M. Sauvageot. Chimie & Industrie, vol. 16, no. 3, Sept. 1926, pp. 411-419.

STELLITE

Welding Application. Stelliting: A New Welding Progress, A. W. Harris. Am. Welding Soc.—Jl., vol. 6, no. 1, Jan. 1927, pp. 14-17.

STREAM POLLUTION

Prevention. The Prevention of River Pollution, F. A. B. Preston. Surveyor. vol. 71, no. 1828, Feb. 4, 1927, pp. 177-180. Standard sewage effluent; disposal of polluting trade effluents; river pollution and fish life; detection of pollution; standards for trade effluents; preliminary treatment; liquid wastes from creameries; beet-sugar factory wastes; methods of treatment; purification of spent gas liquor.

STREET CLEANING

Dust Laying. Dust Laying on City Streets. Pub. Works, vol. 58, no. 2, Feb. 1927, pp. 61-62. Materials and methods employed by 10 large cities; quantities of oil and calcium chloride used and costs per square yard.

STRUCTURAL STEEL

Corrosion. Unlimited Potential Durability of Structural Steel, F. W. Skinner. Brooklyn Engrs'. Club—Proc., vol. 25, Jan. 1927, pp. 82-135. Result of researches carried out by author, to show why, how and when structural steel may be corroded and how it is practical to entirely prevent its corrosion.

Welding and Casting. Replacing Casting with Structural Shapes, W. L. Warner. Am. Welding Soc.—Jl., vol. 6, no. 2, Feb. 1927, pp. 36-44, 11 figs. Discusses applications of welded structural steel parts to replacement of castings.

SULPHURIC ACID

Contact. The Contact Process for Sulphuric Acid, W. H. DeBlois. Can. Min. & Met. Bul., no. 179, Mar. 1927, pp. 304-324, 2 figs. In contact process for manufacture of sulphuric acid, sulphur dioxide gas is made to combine with oxygen of air to form sulphur trioxide which then only requires addition of water to form sulphuric acid; this process is claimed to be one of outstanding achievements in chemical engineering. See also Can. Min. Jl., vol. 48, no. 10, Mar. 11, 1927, pp. 204-209 and 215, 2 figs.

T

TALC

Canada. Talc Deposits of Canada, M. E. Wilson. Canada Dept. of Mines—Geol. Survey—Economic Geology Series, no. 2, no. 2092, 1926, 149 pp. Talc-bearing geological provinces in Canada; general character and origin of talc deposits; talc and soapstone in other countries; statistics.

TERMINALS, RAILWAY

Specifications. Report of Committee XIV—Yards and Terminals. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 294, Feb. 1927, pp. 557-657, 6 figs.

TESTING MACHINES

Repeated-Bending. Repeated-Bending Testing Machine. Engineering, vol. 123, no. 3188, Feb. 18, 1927, pp. 212-214, 5 figs. Equipment for alternating-stress tests of rotating-beam type designed and constructed by C. Schenck, Darmstadt; it is suitable for research work as well as for works laboratories, having advantage that fatigue limit can be determined in few minutes by energy consumption measurements.

THERMODYNAMICS

Absolute Zero. On the Theoretical Impossibility of Absolute Zero and Relation Existing Between This Postulate and the Theory of Nernst (Sur l'impossibilité théorique du zero absolu et sur une relation existant entre ce postulat et le théorème de Nernst), A. Schidlof. Chimie Physique, vol. 23, no. 9, Nov. 25, 1926, pp. 814-820. Postulate of the impossibility of absolute zero leads to establishment of general condition, supplying information on physical properties of all bodies at low temperature.

TRAFFIC

Congestion. The Problem of Traffic Congestion and a Solution, H. W. Corbett. Arch. Forum, vol. 46, no. 3, Mar. 1927, pp. 201-208, 10 figs. Study of physical aspects of city as determined by growth and circulation; author believes that congested centres of city, at least three forms of traffic, (pedestrian, vehicular and fixed rail), do not belong on same level; it seems rational, therefore, that whell traffic should be placed on present street level; rail traffic underground, as subways; and foot traffic be raised one storey above street level, carrying bridges across at all corners, and at one or two points in long blocks as well, so that people can move uninterruptedly throughout as large a district as is covered by expansion of double-decking idea.

Railway and Highway. Economics of Co-ordinating Motor-Vehicle and Railroad Transportation, W. J. Cunningham. Soc. Automotive Engrs.—Jl., vol. 20, no. 3, Mar. 1927, pp. 372-378.

TRANSFORMERS

Design. The Design of Current Transformers, C. T. Melling. Instn. Elec. Engrs.—Jl., vol. 65, no. 362, Feb. 1927, pp. 283-284, 2 figs. Principal advantages resulting from use of current transformers; purposes for which they are used; requirements.

Testing. Vector Representation of Transformer Test Conditions, A. Stigant and H. M. Lacey. Elec. Times, vol. 71, no. 1845, Mar. 3, 1927, pp. 304-306, 5 figs. Presents vector diagrams which show clearly currents, pressures and fluxes present in transformer under different test conditions.

V

VALVES

Machining. Machining Valves to Close Limits, A. Murphy. Can. Machy., vol. 37, no. 8, Feb. 24, 1927, pp. 15-17, 9 figs. Adoption of modern production methods, to insure low costs, in manufacture of steam specialties at plant of James Morrison Brass Mfg. Co.

VENTILATION

Schools. School Ventilation from the Viewpoint of the School Architect, W. B. Ittner. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 3, Mar. 1927, pp. 119-127, 2 figs.

W

WATER SUPPLY

Consumption Determination. Water Consumption for Various Purposes in Terms of Depth and Area, C. H. Lee. Am. Water Works Assn.—Jl., vol. 17, no. 2, Feb. 1927, pp. 193-214, 3 figs. Results of determination of depth of water used per acre per annum in general municipal service and in special services for various American cities.

Protection. Protection of Ontario Water Supplies, A. E. Berry. Can. Engr., vol. 52, no. 8, Feb. 22, 1927, pp. 231-232. Activities of Ontario Dept. of Health in water works field; operation of Ontario Public Health Act; supervision and control of municipal water supplies.

WATER TREATMENT

Chlorination. Modern Aspects of the Treatment of Water with Chlorine, N. J. Howard. Contract Rec., vol. 41, no. 10, Mar. 9, 1927, pp. 240-242. Considerable advance in last 20 years in application of chlorine to water sterilization and purification; prechlorination and superchlorination; destruction of algæ growths; care in using ortho-tolidin test for free chlorine.

Progress. Have New Methods Improved Water Purification? C. A. Brown. Water Works Eng., vol. 80, no. 5, Mar. 2, 1927, pp. 273-274 and 312-314. Review of progress that has taken place.

WELLS

Water-Supply Source. Wells as a Source of Water Supply, M. Pequegnat. Can. Engr., vol. 52, no. 8, Feb. 22, 1927, pp. 241-244, 2 figs. Water supply of Kitchener, Ont., obtained from 23 wells; total consumption approximately 2,000,000 imperial gallons; size, capacity and other characteristics of wells; drilling and casing details; methods of pumping employed.

WELDING

Cast Aluminum. How to Weld Cast Aluminum. Brass World, vol. 23, no. 2, Feb. 1927, pp. 47-48, 4 figs. Difficulties encountered and how to overcome them.

Cast Iron. Autogenous and Electric Welding of Cast Iron. Metallurgist, (Supp. to Engineer), Feb. 25, 1927, pp. 19-21, 2 figs. Review of work by P. Schimpke, published in Stahl u. Eisen, Aug. 26, 1926, giving comprehensive study of modern practice with particular reference to cast iron.

Electric. *See Electric Welding, Arc.*

Flow of Metal. The Flow of Welding Metal, J. B. Green. Welding Engr., vol. 12, no. 2, Feb. 1927, pp. 25-29, 13 figs. Slow-motion movies, taken with infra-red light on special film, are used to show welding qualities of filler roads.

Oxy-Acetylene. *See Oxy-Acetylene Welding.*

Underground Pipe. Welding Found Convenient for Buried Pipe, L. A. Foster. Power Plant Eng., vol. 31, no. 5, Mar. 1, 1927, pp. 297-298, 5 figs. Years of service in underground piping for heating systems proves practicability of welding pipe joints.

WELDS

Fatigue Resistance. Suggested Programme for an Investigation of the Fatigue Resistance of Welds, American Bureau of Welding, H. L. Whittemore. Am. Welding Soc.—Jl., vol. 6, no. 1, Jan. 1927, pp. 21-24.

WINDMILLS

Rotor Application. Industrial Application of the Flettner Rotor, F. O. Willhofft. Mech. Eng., vol. 49, no. 3, Mar. 1927, pp. 249-253, 11 figs. Characteristics of rotor and its suitability for application to wind wheels; particulars of proposed 100-ft. wheel with savonius rotors to generate 183 h.p.

Z

ZINC

Production and Refining. The Production and Refining of Remelted Zinc, E. R. Thews. Metal Industry (N.Y.), vol. 25, nos. 2 and 3, Feb. and Mar. 1927, pp. 60-62 and 107-108, 3 figs. Modern practice in producing good zinc from scrap.

Preliminary Notice

of Applications for Admission and for Transfer

May 18th, 1927.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in June 1927.

R. J. Durley, *Secretary.*

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

HEWITT—HAROLD LESLIE, of Temiskaming, Que., Born at Toronto, Ont., Oct. 14th, 1903; Educ., B.A.Sc., Univ. of Toronto, 1927; 1925 (summer), dfting in U.S. War Dept., Buffalo; 1926 (summer), dfting in Kippawa pulp mill; at present, dfting in Kippawa pulp mill.

References: T. R. Loudon, C. R. Young, A. R. Babbitt, L. S. Dixon, H. J. Whiting.

HINTON—ERIC, of Deer Lake, Nfld., Born at Warwick, England, Jan. 29th, 1901; Educ., C.E. diploma, I.C.S., 1922; 1918-23, pupil to F. Latham, M.I.C.E., municipal engr., Penzance, England; 1923, surveys of property, preparation of plans for solicitors and others of highways and seawalls; 1924-25, asst. to res. civil engr. for Armstrong Whitworth & Co., Ltd., hydro-electric power development, Deer Lake; 1926, Nfld. Power & Paper Co., Ltd., hydraulic records, control of water, surveys for proposed extensions, temporary ry. diversions, design of proposed reinforced concrete steel truss bridge abutments, etc.; at present, asst. to hydro-electric engr. of same company in capacity of hydraulic engr.

References: R. J. S. Sly, H. C. Brown, R. L. Weldon, L. R. Brown.

McCUTCHEON—MANFORD WEINDAL, of Montreal, Que., Born at Lakeview, N.B., Sept. 4th, 1894; Educ., B.Sc., McGill Univ., 1919; 1916 (summer), asst. on survey for hydro-electric plant, Cape Split, N.S.; 1917 (summer), asst. topographical survey, B.C.; May 1918 to March 1919, lieut. Can. Engrs.; 1919 to date, instrumentman in dist. engr.'s office, C.N.R., Montreal, work includes dfting, estimating and outside supervising.

References: H. M. MacKay, W. Walker, C. M. McKergow, J. Weir, A. C. Oxley.

STUART—WILLIAM GREY, of Edmonton, Alta., Born at Moulmein, Burma, March 27th, 1892; Educ., Glasgow High School, Glasgow Technical College and Glasgow University, Scotland, 1900-1910; 1910-14, on location as topographer and instrumentman with constrn. dept., C.P.R.; 1914-19, overseas as lieut. R.F.C. and Royal Engineers; 1919-24, district hydrometric engr., Dept. of the Int., collecting data for water power dev.; 1925 to date, Water Power & Reclamation Service, as district engr. inspecting and laying out drainage schemes and inspecting industrial schemes.

References: W. A. James, J. S. Tempest, A. L. Ford, D. Whittaker, H. H. Tripp.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

KEARNS—NORMAN HENRY, of Chuquicamata, Chile, S.Am., Born at Toronto, Ont., June 17th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1919; 1913 (summer), rodman and chainman, city of Toronto bridge dept.; April 1917 to Nov. 1918, physical testing and research engr., Can. Aeroplane Co., Ltd., Toronto; 1919-1920, asst. to city engr., Niagara Falls, Ont., field and office work on pavement and sewer programme; 1920-23, field and office engr. on 50,000 h.p. hydro-electric plant, Sao Paulo Electric Co., Brazil, S.Am.; 1923-25, constrn. engr. i/c constrn. on 25,000 h.p. addition to above plant; May to Oct. 1925, constrn. foreman, Chile Exploration Co., Chuquicamata, Chile; Oct. 1925 to Feb. 1927, asst. supt. of constrn. on extension to reduction plant of Chile Exploration Co. at Chuquicamata; Feb. 1927 to date, general supt. of constrn. on above work.

References: D. T. Black, L. M. Arkley, P. Gillespie, R. W. Angus, C. R. Scott.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

CREGEEN—KENNETH THOMAS, of Montreal, Que., Born at Montreal, Dec. 31st, 1898; Educ., B.Sc., McGill Univ., 1923; 1920 (summer), electrical power and light installation and mtce. work at C.P.R. Angus shops; 1923 (summer), M.L.H. & P. Co., electrical distribution dept., general distribution work, investigation of distribution problems; 1923-24, Sun Life Assurance Co. of Canada, asst. to bldg. supt. and engr., assisting in management of plant and supervising general mtce. of head office bldg., Montreal; Nov. 1924 to date, with same company as engr. i/c building mtce.

References: E. A. Ryan, F. A. Combe, A. J. C. Paine, C. V. Christie, A. R. Roberts.

Engineering Index

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A

AERIAL PHOTOGRAPHY

Highway Planning. How Aerial Maps Aid in Planning Highway Improvements, G. C. Diehl. Highway Mag., vol. 18, no. 3, Mar. 1927, pp. 59-61, 2 figs. Methods of making and benefits of using aerial surveys are given from experience in planning for Buffalo's growing traffic needs.

Stereoscopic Examination. The Stereoscopic Examination of Air Photographs, M. Hotine. Royal Engrs'. Jl., vol. 41, no. 1, Mar. 1927, pp. 125-145, 11 figs. Stereoscope; orientation; optical construction; visual factors; stereoscopic reconstruction; extension to tilted photographs; use of parallactic grids.

AIR COMPRESSORS

Diesel Engines. Care of the Multi-Stage Air Compressor on Diesel Engines, A. B. Newell. Nat. Engr., vol. 31, no. 4, Apr. 1927, pp. 153-156. How to deal with troublesome valves; problems connected with compressor operation; necessity of pure air; danger of over-lubrication.

Volume Control. Volume Control for Compressor Economy. Power Plant Eng., vol. 31, no. 7, Apr. 1, 1927, pp. 404-419, 13 figs. Popularity of motor-driven compressor due largely to successful application of mechanical control system.

AIRCRAFT

Production Control. Aircraft Production. Automobile Engr., vol. 17, no. 226, Mar. 1927, p. 99. Details of simple and effective control system.

AIRCRAFT CONSTRUCTION MATERIALS

Dopes. Acro Dopes and Varnishes, H. T. S. Britton. Indus. Chemist, vol. 3, no. 26, Mar. 1927, pp. 116-120, 2 figs. Considers essential properties which should be possessed by dope film, deposited in and on surface of aircraft fabric; preparation of solutions.

AIRPLANES

Accessories. Accessories and Equipment of Airplanes (Les accessoires et l'equipement des avions actuels), C. Martinot-Lagarde. Technique Moderne, vol. 19, no. 5, Mar. 1, 1927, pp. 143-147, 12 figs. Deals with accessory equipment, such as controllers, radiators, fuel feed pumps, motor-control apparatus, safety apparatus, electrical and photographic equipment, etc.

Air-Cooled vs. Water-Cooled. Air-Cooled Fighters or Water-Cooled? F. W. Wead. Aviation, vol. 22, no. 12, Mar. 21, 1927, pp. 565-567, 5 figs. Navy tests show air- and water-cooled planes to have equivalent speed characteristics; water-cooled plane steadier in combat; air-cooled plane better climber.

Performances. Comparison of Aircraft Performances, H. A. Mettam. Flight (Aircraft Engr.), vol. 19, no. 8, Feb. 24, 1927, pp. 100a-100c, 1 fig. Derivation of Everling quantities in British symbols and units, and their correlation with methods of performance comparison already in use in England.

Wing Spars. Approximations for Column Effect in Airplane Wing Spars, E. P. Warner and M. Short. Nat. Advisory Committee for Aeronautics—Report, no. 251, 1927, pp. 3-20, 15 figs.

AIRSHIPS

Aircraft Carriers. Large Airships as Aircraft Carriers, R. A. deH. Haig. Aviation, vol. 22, no. 13, Mar. 28, 1927, pp. 611-614, 5 figs. British experiments with airplanes leaving and hooking on to airships in flight.

ALIGNMENT CHARTS

Engineering Formulas, Application to. The Alignment Chart and Its Applicability to Engineering Formulas, D. Ramadanoff. Sibley Jl. of Eng., vol. 41, no. 3, Mar. 1927, pp. 83-85 and 97, 3 figs. Deals with use and construction of charts.

ALLOYS

Aluminum. *See Aluminum Alloys.*
Bearing Metals. *See Bearing Metals.*
Brass. *See Brass.*
Bronzes. *See Bronzes.*
Copper. *See Copper Alloys.*

ALUMINUM

Finishing Process. Finishing Process for Aluminum and Its Alloys (Sur un nouveau procédé d'ornementation de l'aluminium et de ses alliages), L. Guillet. Académie des Sciences—Comptes Rendus, vol. 184, no. 3, Jan. 17, 1927, pp. 134-136. Pacz has shown that if aluminum or alloy rich in aluminum is tempered in solution of sodium fluosilicate, nickel sulphate and potassium nitrate in 4 liters of water at 70 to 80 deg., colored lines appear which blacken quickly in bath; design produced may be varied according to relative motion with respect to liquid accorded to metal; deposits appear to start from impure spots on surface, and their extent is strictly limited by electrolytic protection; corrosion readily starts along lines of pattern, with formation of alumina.

ALUMINUM ALLOYS

Aluminum-Silicon. Aluminum-Silicon Alloys, H. Ehlermann. Eng. Progress, vol. 8, no. 3, Mar. 1927, pp. 75-76, 3 figs. Discusses wide use of these alloys owing to their excellent casting properties which increase tensile strength by means of refining process; employment for pressure die castings and for structural work.

Casting. Light Aluminum Casting Alloys. Brass World, vol. 23, no. 3, Mar. 1927, p. 76. List of aluminum casting alloys presenting fairly complete arrangement of all alloys ordinarily used in aluminum foundries, and furnishnig mixtures which may prove more suitable than those at present used by some establishments.

Corrosion. The Corrosion of Aluminum Alloys, H. Sutton. Metallurgist (Supp. to Engineer), Mar. 25, 1927, pp. 36-37.

Wrought. Wrought Light Alloys, W. Rosenhain. Metallurgist (Supp. to Engineer), Mar. 25, 1927, pp. 39-40, 1 fig.

AMMONIA

Vapor Tension of Solutions. Vapor Tension of Ammonia Solutions, J. E. Starr. Ice & Refrigeration, vol. 72, no. 3, Mar. 1927, pp. 252-253. Revival of interest as to properties of ammonia solutions in water due to attempts made to produce very small apparatus where cost is of greater importance than efficiency of performance; data on subject entirely sufficient for practical commercial purposes available.

AMMONIA CONDENSERS

Design and Operation. A Challenge to Refrigerating Designs, H. J. Macintire. Power, vol. 65, no. 12, Mar. 22, 1927, pp. 437-438, 3 figs. Critical examination of present-day ammonia condensers; all are found faulty and better design is predicted.

Economic Balances in the Design and Operation of the Ammonia Condenser, T. K. Sherwood. Refrig. Eng., vol. 13, no. 8, Feb. 1927, pp. 253-259, 8 figs.

APPRENTICES, TRAINING OF

Automotive Industry. A Comprehensive Apprenticeship Programme for the Automotive Industry, H. A. Frommelt. Soc. Automotive Engrs.—Jl., vol. 20, no. 4, Apr. 1927, pp. 443-453, 4 figs. Author remarks that one of the greatest future developments in automotive field will take place through training of personnel; outstanding examples of success of personnel training prove by facts possibility of comprehensive application of apprenticeship; describes army personnel training at Camp Holabird at Baltimore.

Economic Value. The Economic Value of Apprentices, S. De Hart. Indus. Mgmt. (N.Y.), vol. 73, no. 4. Apr. 1927, pp. 227-228, 3 figs. Methods and policy of LeBlond Machine Tool Co.; apprentices are not matter of cost but are form of investment; it is not necessary to have a very elaborate or expensive apprenticeship system in order to obtain results.

ASH HANDLING

Hydro-Mechanical Plants. Hydro-Mechanical Conveying, Reichel. Indus. Mgmt. (Lond.), vol. 14, no. 4, Apr. 1927, p. 120. Describes plants for handling ashes and clinkers from boilers and gas producers; hydraulic conveyor meets most stringent requirements, effects considerable saving in cost and by quenching dust, heat and gas, produces ideal hygienic conditions at small expense.

AUTOMOBILE ENGINES

Cylinder-Block Machining. Machining the Morris Cylinder Block, I. W. Chubb. Am. Mach., vol. 66, nos. 9, 10, 11, 12 and 13, Mar. 3, 10, 17, 24 and 31, 1927, pp. 359-362, 413-415, 445-448, 481-483 and 527-528, 36 figs.

Supercharging. The Supercharging of Aircraft and Motor Vehicle Engines, A. H. R. Fedden. Automobile Engr., vol. 17, no. 226, Mar. 1927, pp. 106-112 and (discussion) 112-114, 14 figs. Describes main types of compressors which have already been applied to high-speed internal-combustion engines, advantages and difficulties of this form of supercharging, and likely lines of development.

AUTOMOTIVE FUELS

Airships. *See Airships, Fuels for.*

Oil Engine. The Supply of Fuel for Oil Engines, E. J. Kates. Power, vol. 65, no. 13, Mar. 29, 1927, pp. 484-486, 2 figs. Extent of oil underground not known; new field discovered each year; most of fuel oil now used uneconomically under boilers; no decided increase in price for decades.

Vegetable Wastes. Running a Gas Engine on Vegetable Waste. English & Amateur Mechanics, vol. 1, no. 22, Mar. 25, 1927, pp. 367-368, 5 figs. Important British development of far-reaching possibilities for country and Colonial purposes.

AUTOMOBILES

Hazards. Automobile Hazard in Cities and Its Reduction, W. J. Cox. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 4, Apr. 1927, pp. 513-539, 3 figs.

AVIATION

Civil. Civil Aviation, N. J. Hulbert. Instn. Aeronautical Engrs.—Jl., vol. 1, nos. 1, 2 and 3, Jan., Feb. and Mar. 1927, pp. 35-36, 27-28 and 19-20. Review of development; author points out there is considerable public apathy toward adopting aerial transport, because it is very expensive, but primarily because public regard it as dangerous; author discusses these two objections and means of overcoming them.

Commercial. Commercial Aerial Navigation (La navigazione aerea commerciale), G. Vallecchi. Sindacato Nazionale Fascista Ingegneri, vol. 2, no. 1, Jan. 1927, pp. 4-9, 1 fig. Deals with commercial, technical and financial problems and aspects.

Europe. European Air Transportation, H. D. Lindsley. Aviation, vol. 22, no. 13, Mar. 28, 1927, pp. 617-619, 3 figs. Report on development of civil aviation in Europe.

Night Flying. Night Flying in Bad Weather, E. T. Allen. Aviation, vol. 22, no. 10, Mar. 7, 1927, pp. 461-463, 2 figs. Some air-mail pilot's problems; outlines problems involved and ways in which they may be expected to be solved in near future.

B

BEAMS

Continuous. Continuous Beams, J. J. Harty. Boston Soc. Civ. Engrs.—Jl., vol. 14, no. 3, Mar. 1927, pp. 169-178 and (discussion) 178-187, 12 figs. Author presents theory in sufficient detail to familiarize reader with method.

Gunite Encasement. Tests of Corroded Steel Beams Restored with Gunite, J. R. Shank. Eng. News-Rec., vol. 98, no. 14, Apr. 7, 1927, pp. 574-576, 6 figs. Beams with plain and reinforced encasement tested in comparison with bare beams; bond found to be excellent.

BEARING METALS

Production and Refining. The Production and Refining of White Bearing Metals. Engineering, vol. 123, no. 3191, Mar. 11, 1927, pp. 282-284, 2 figs. Influence of copper in low-tin metals; in metals high in tin, lead is considered impurity which may be present in comparatively small amounts only; melting-pot plant for cleaning and alloying of white bearing metals; suitable scrap metals; how copper is removed from scrap; methods of refining.

BELT DRIVE

Horizontal Quarter-Turn. Report of Experiments on Horizontal Quarter-Turn Drives, R. F. Jones. Belting, vol. 30, no. 3, Mar. 1927, pp. 22-32, 6 figs. Study of transmission capacity as compared with normal horizontal drives; information on correct pulley sizes and centres.

BELTS

Leather. Notes on Leather Belts. Am. Mach., vol. 66, no. 12, Mar. 24, 1927, p. 507. Factors for various arcs of contact; size of belts; joining belt. Reference-book sheet.

BLAST FURNACES

Oxidation Processes. The Influence of Oxidation Processes in the Blast Furnace, F. Wüst. Iron & Coal Trades Rev., vol. 114, no. 3082, Mar. 25, 1927, pp. 480-481, 3 figs. Translated from Stahl u. Eisen, vol. 35, no. 554, Mar. 31, 1927, pp. 279-281, 2 figs. See also translation Foundry Trade Jl.

BLOWERS

Impellers, Cycloidal Curves. The Generation of Cycloidal Curves, P. M. Mueller. Mech. Eng., vol. 49, no. 4, Apr. 1927, pp. 359-360, 6 figs.

BOILER EXPLOSIONS

Autogenously Welded Boiler. Explosion of an Autogenously Welded Boiler (Explosion d'une chaudière construite par soudure autogène). Génie Civil, vol. 90, no. 10, Mar. 5, 1927, pp. 245-246, 2 figs.

BOILER FURNACES

Pulverized-Coal. Temperatures in Powdered-Coal Furnaces Having Extended Radiant-Heat Absorbing Surfaces, R. A. Sherman. Mech. Eng., vol. 49, no. 4, Apr. 1927, pp. 335-338, 8 figs. Progress Report of A.S.M.E. Special Research Committee on Boiler-Furnace Refractories.

BOILER OPERATION

Economy in. Operating Boilers at the Minimum Cost, C. M. Ware. Combustion, vol. 16, no. 3, Mar. 1927, pp. 153-154, 2 figs. By operating boiler short period and then calculating furnace and fuel-burning equipment maintenance per ton of fuel burned, and repeating many times for short and long and intermediate periods of operation, general characteristic curve can be established, which will show generally that furnace and fuel-burning equipment maintenance, per ton of fuel burned, is at minimum after certain operating period.

BOILER TUBES

Design. Modern Methods Influence Boiler Tube Size. Power Plant Eng., vol. 31, no. 7, Apr. 1, 1927, p. 402, 1 fig. Heine VX boiler, new bent-tube type, design for pressures in excess of 325-lb. gauge with particular reference to increased tube spacing and reduced tube diameters.

BOILERS

Blow-Off. Design and Use of the Boiler Blow-Off, C. L. Hubbard. Textile World, vol. 71, no. 14, Apr. 2, 1927, pp. 63-65, 11 figs. Limiting degree of concentration of water in boiler by blowing down; method of determining quantity of water to be blown off daily; precautions required in blowing-off boiler; arrangement and protection of blow-off pipes; valves and cocks; blow-off tanks.

Electric. Electric Boilers. A.E.G. Progress, vol. 2, no. ½, Apr. 1926, pp. 40-44, 4 figs. Electric boilers for low-tension direct and single-phase or 3-phase current; indirect and direct resistance heating; Penzold system of electric boilers and its advantages.

Factory Power Plants. Selecting the Factory Power Plant Boiler, W. A. Shoudy. Mfg. Industries, vol. 13, no. 3, Mar. 1927, pp. 185-188, 5 figs. Principles governing choice of most suitable installation.

Locomotive. *See Locomotive Boilers.*

Pulverized-Coal-Fired. Calumet Boiler Generates 300,000 lb. of Steam Per Hour. Power, vol. 65, no. 14, Apr. 5, 1927, pp. 519-520, 3 figs. Interesting application of pulverized-fuel for central station use has been made in Calumet Station of Commonwealth Edison Co.

Ratings. Boiler Ratings—and Other Absurdities, R. H. Allen. Combustion, vol. 16, no. 3, Mar. 1927, pp. 161-162. Author points out that before reforms can be brought about, it is necessary to demonstrate their necessity, and, with this in view, he discusses figures from boiler test published in recent bulletin; operating costs depend on thermal efficiency and quality of coal; both should therefore be stated and it should be made clear whether gross or net calorific value of coal is basis of figures.

Safety Valves. Fundamentals of Safety-Valve Design, R. J. S. Pigott. Power, vol. 65, no. 16, Apr. 19, 1927, pp. 580-583, 8 figs. Certain basic principles apply to all types of safety valves; these are clearly explained and illustrated by their application to design of high-lift valve.

Waste-Heat. Results of Tests on Waste-Heat Boilers, M. Ebner and M. Hayes. Blast Furnace & Steel Plant, vol. 15, no. 4, Apr. 1927, pp. 191-192, 1 fig. Installation of boilers on three 90-ton open-hearth furnaces; after service of 9 months, operation is checked.

BRASS

Electric Melting. Twenty-Five Years of Non-Ferrous Electrothermics; Fifteen Years of Electric Brass Melting, H. W. Gillett. Am. Electrochem. Soc.—Advance Papers, Apr. 28-30, 1927, no. 24, 20 pp.

BREAKWATERS

Concrete Cribs for. Concrete Cribs for Breakwater and Dockage, J. H. Tromanhauser. Port & Terminal, vol. 7, no. 2, Feb. 1927, pp. 7-9, 6 figs. Marine construction methods on new Welland Canal; floating-pontoon system of construction; stripping and reassembling.

BRIDGE ERECTION

Caissons. Caisson for Montreal Harbour Bridge. Can. Engr., vol. 52, no. 13, Mar. 29, 1927, pp. 387-388, 3 figs. Large steel caisson for footing of main pier; weighs 450 tons and will carry 4,800 tons; working chamber is 7 ft. high.

BRIDGE PIERS

Foundations in Chalk. Bridge-Foundations on Transported Chalk, with Notes on Piled and Monolith Foundations, J. P. Porter. Instn. Civ. Engrs.—Sessional Notices, no. 3, Mar. 1927, pp. 72-74. Deals with design of suitable foundations in depressions which appear to have been filled with disintegrated chalk transported perhaps from higher levels; investigation of site conditions by means of trial piles; factors limiting utility of piling formulas; shows that foundations depending on bearing action are to be preferred to foundations utilizing frictional support; considerations in design of monoliths.

BRONZES

Bearing-Metal. Bearing-Metal Bronzes, H. J. Roast and F. Newell. Eng. Jl., vol. 10, no. 4, Apr. 1927, pp. 213-221, 35 figs. Essential constants of bronzes in everyday use as determined by series of tests with metals carried out under practical working conditions.

Nickel-Aluminum. Nickel-Aluminum Bronzes, E. D. Gleason. Metal Industry (N.Y.), vol. 25, no. 4, Apr. 1927, p. 149. Alloy is superior to phosphor, manganese and gun bronzes and special steels as set forth by U.S. Navy on specifications for inspection of materials; sand-cast materials; various bronzes and their properties.

BUILDINGS

Hurricane, Effect of. Florida Hurricane Damage as Seen by a Building Official, L. F. Fletcher. Eng. News-Rec., vol. 98, no. 7, Feb. 17, 1927, pp. 281-282. Faulty application of materials main cause of loss; anchorage and bracing; should design for 30-lb. pressure.

Valuation. Valuation Work from the Engineer's Standpoint, J. Hole. Eng. Jl., vol. 10, no. 4, Apr. 1927, pp. 207-212. Outline of general valuation work, emphasizing valuation of buildings, and dealing with depreciation.

C

CAR DUMPERS

Electric. First Electrically-Operated Car Dumper, C. C. Clymer and C. S. Albright. Elec. World, vol. 89, no. 14, Apr. 2, 1927, pp. 700-702, 4 figs. First all-electric machine to be used on Great Lakes; sequence of operations; features of electrical equipment.

Types. Car Dumpers (Les appareils culbuteurs pour le déchargement des wagons). Génie Civil, vol. 90, no. 10, Mar. 5, 1927, pp. 233-237, 11 figs. Deals with bascule system for handling of large quantities of material, which effects total emptying of car in one operation; this system is employed to great extent in America and also in Germany; car dumpers of Wellman Smith Owen Eng. Corp.

CAST IRON

Constitution. The Constitution of Steel and Cast Iron, F. T. Sisco. Am. Soc. Steel Treating—Trans., vol. 11, no. 4, Apr. 1927, pp. 626-635. Discusses constitution of iron-carbon alloys containing 4.30 to 6.67 per cent carbon; constitutional changes in this series when cooled from molten state to atmospheric temperature; behaviour of whole series of iron-carbon alloys containing 0.01 to 6.67 per cent carbon, in cooling from high temperature, is reviewed.

Electric Melting. Grey Cast Iron from the Point of View of the Electric Furnace, G. K. Elliot. West. Machy. World, vol. 18, no. 3, Mar. 1927, pp. 122-123 and 136. Correct understanding of chemistry of both acid and basic-hearth electric furnaces should lie at foundation of every decision for or against adoption of electric furnace in competition with cupola; points of difference in behaviour of basic and acid furnaces toward molten cast iron.

Grate Bars. Cast Iron Alloy Developed for Grate Bars. Ry. Mech. Engr., vol. 101, no. 3, Mar. 1927, pp. 181-182, 2 figs. Placed on market under trade name of Nogroth metal, an air-furnace product; its structure resembles that of white cast iron and has many properties of cast steel; it retains its original strength at high temperatures, nor will it grow when exposed to temperatures below melting point.

Semi-Steel. *See Semi-Steel.*

Shear Tests. Ring Shear Tests for Cast Iron, M. Rudeloff. Metallurgist (Supp. to Engineer), Mar. 25, 1927, p. 47, 1 fig. Translated from Giesserei, vol. 13, Aug. 14 and 21, 1926. See reference to original article in Eng. Index 1926, p. 132.

CASTING

Centrifugal. Centrifugal Casting of Steel, L. Cammen. Can. Machy., vol. 37, nos. 10, 11, 12, 13 and 14, Mar. 10, 17, 24, 31 and Apr. 7, 1927, pp. 32-33, 34-36, 20-21, 22-24 and 35 and 48-50, 7 figs. Deals with centrifugal tube casting and shows its present and prospective field of application and limitations, particularly where centrifugal tube casting comes into competition with piercing process. Paper read before Am. Soc. Steel Treating.

CEMENT

Lumnite. Some Further Notes on Uses and Characteristics of Lumnite Cement, J. L. Miner. Concrete, vol. 30, no. 4, Apr. 1927, pp. 35-38, 1 fig. Properties of high alumina cement; directions for its use; precautions to be observed.

Specifications. United States Government Master Specifications for Cement, Masonry. U.S. Bur. Standards—Cir., no. 221, specification no. 443, Feb. 1, 1927, 9 pp. General specifications; type and grade; materials and workmanship; requirements; methods of inspection, sampling and test; packing and marking.

CENTRAL STATIONS

Efficiency. The Efficiency of a Power Station at Various Outputs, L. J. C. Wigan. Elec. Engr., vol. 3, no. 11, Feb. 15, 1927, pp. 423-425, 6 figs. Presents calculations for obtaining idea of theoretical amounts of coal required; station efficiency, actual and theoretical, can also be found based on average calorific value of coal of 13,230 B.t.u. as fired.

Ground Busbars. The Station Ground Bus, W. W. Lewis. Elec. Light & Power, vol. 5, no. 4, Apr. 1927, pp. 29-30, 2 figs. Problem of considerable importance in laying out generating stations and substations is determination of size of station ground bus, which depends upon amount of short-circuit current and time this current flows based on allowable temperature rise.

CHIMNEYS

NATURAL-DRAUGHT. Economical Design of Natural-Draught Chimneys, J. G. Mingle. Power Plant Eng., vol. 31, no. 7, Apr. 1, 1927, pp. 399-402, 2 figs. Design methods which, taking into account all operating conditions, will result in most economical combination of chimney height and diameter.

CHROMIUM-NICKEL STEEL

MOLYBDENUM IN. Molybdenum in Nickel-Chromium Medium Carbon Steels. Chem. Age (Met. Sect.), vol. 16, no. 401, Mar. 5, 1927, pp. 17-19. Investigation of influence of molybdenum, carried out by Research Department, Woolwich; thermal critical ranges; microstructure and heat treatment; mechanical properties.

CIRCUIT BREAKERS

LOW-VOLTAGE APPLICATIONS. Selection of Circuit-Breakers for Low-Voltage Applications, B. S. Burke. Power, vol. 65, no. 14, Apr. 5, 1927, pp. 513-516, 2 figs. Dividing line between cases in which air-brake circuit-breaker should be used and those in which oil circuit-breaker should be used is very elastic and subject to numerous qualifications; however, there are certain definite considerations that affect application of these two types, and author outlines these conditions.

COAL

CHEMICALS FROM. Chemicals from Coal and Lignites. C. W. Dabney. Mfrs. Rec., vol. 91, no. 12, Mar. 24, 1927, pp. 66-68. Discusses many substances to be derived from distillation of coals and lignites and various uses to which these chemicals may be put.

SAMPLING AND TESTING. Some Notes on Coal Sampling and Testing, F. Wade. Elec. Times, vol. 71, no. 1849, Mar. 31, 1927, pp. 452-453, 3 figs. In writer's opinion, there is no better method of obtaining fair sample from truck or barge than that used in some of larger American stations by which tapered steel pipe is driven down into coal at several positions in truck, these points being carefully selected so as to give representative sample from whole of truck; when sampling for boiler efficiency; test for volatile matter also calls for standard conditions in regard to temperature at which it is carried out; ash- and calorific-value tests.

SCIENTIFIC USE OF. Coal and Its Abuse, A. Howell. Junior Instn. Engrs., vol. 37, Feb. 1927, pp. 205-209. Points out that Great Britain has in past made least instead of most use of coal; remedy lies in scientific utilization of raw coal by process of low-temperature carbonization and manufacture of patent fuels, with which processes are inseparably associated production of light and heavy oils, gas, electrical energy and valuable by-porducts.

CALORIFIC POWER. Influence of Ash on Calorific Power (L'influence des cendres sur le pouvoir calorifique), R. Stumper. Société Chimique de Belgique—Bul., vol. 5, no. 11, Nov. 1926, pp. 417-421. Net calorific power calculated from heat of combustion, determined by bomb calorimeter and percentage of ash by given formula, is plotted against ash content for large number of Belgian coals and found to fall slightly as value of ash rises.

PULVERIZED. *See Pulverized Coal.*

COAL HANDLING

WHARF FACILITIES. B. & M. Erects Large Coal-Handling Facilities at Boston. Ry. Age. vol. 82, no. 15, Mar. 12, 1927, pp. 885-888, 4 figs. New unloading towers and 440-ft. storage and reclaiming bridge will effect large savings.

COAL MINES

ROCK DUSTING. Rock Dusting is More Effective in Preventing Coal Dust Explosions Than Water, P. H. Burnell. Coal Age, vol. 31, no. 14, Apr. 4, 1927, pp. 494-496, 1 fig. Ventilation of mine and temperature of air have small influence on initiation and propagation of coal dust explosions; important factors are quantity and quality of dust and volume of workings.

COAL MINING

MACHINE LOADING. Mechanical Loading in Narrow Work, S. S. Lanier, Jr. Min. Congress Jl., vol. 13, no. 4, Apr. 1927, pp. 307-309, 5 figs. Results obtained during 6-month period indicate cost of machine loading high as hand loading, but advantage of rapid development heavily overbalances cost; they also indicate that conveyors have come to stay whether fed by hand or mechanical means.

COAL WASHING

DRAINAGE AND DRYING. Drainage and Drying of Coal After Washing; Its Principles and Practice, F. J. Warden-Stevens. Coal Age, vol. 31, no. 12, Mar. 24, 1927, pp. 430-433, 4 figs. Deals with use of centrifugal machines for draining of coal, under following heads: (1) centrifugal force, (2) time of action, (3) size of coal, (4) quality of fines, (5) initial moisture, (6) mass of coal on which centrifugal force acts.

COLD STORAGE

INSULATION. Protection of Cold Storage Insulation, C. H. Herter. Power Plant Eng., vol. 31, no. 8, Apr. 15, 1927, pp. 475-476. To prevent detrimental effects of moisture on corkboard insulation, various asphalt products have been developed.

COMBUSTION

SURFACE. Applications of Surface Combustion (Les applications modernes de la combustion par surface), J. Brunswick. Technique Moderne, vol. 19, no. 3, Feb. 1, 1927, pp. 72-74, 6 figs. See brief translated abstract in Power Engr., vol. 22, no. 253, Apr. 1927, p. 155.

CONCRETE

CRUSHED STONE AS AGGREGATE. Crusher Run Stone as Concrete Aggregate, J. G. Ross and M. F. Macnaughton. Can. Engr., vol. 52, no. 13, Mar. 29, 1927, pp. 393-394. Discussion of qualities of crushed stone to be used more particularly in manufacture of Portland cement concrete; poor stone should be eliminated; uniform grading of stone desirable.

CONSTRUCTION AND INSPECTION. Construction and Inspection of Concrete, J. Empey. Contract Rec., vol. 41, no. 11, Mar. 16, 1927, pp. 265-266. Practical hints as to making of good concrete. Paper read before Conference of County and Township Road Engs. and Superintendents of Ontario.

DENSITY. Density of Concrete and Water-Cement Ratio, F. R. McMillan. West. Soc. Engrs.—Jl., vol. 32, no. 1, Jan. 1927, pp. 29-35 and (discussion) 35-38, 5 figs. Strength and impermeability of concrete determined by quality of paste; permeability as cause of disintegration; importance of curing on density of concrete; effect of grading and mix on density.

IMPROVEMENTS. The Slow Progress in the Improvements of Concrete, H. C. Badder. Roads & Road Constr., vol. 5, no. 50, Feb. 1, 1927, pp. 37-38. Points out that setting up of Portland Cement Standard Committee has undoubtedly hindered early development of better cements; this weapon has been used against cements made of finely ground slag and lime; but it seems to have broken down in case of aluminous cements; low-limed cement can be made from more suitable materials than slag; Portland cement of low-lime content will have much less free lime when hydrated than present ordinary Portland cement, and will form concrete more impervious, less subject to cracking, with less expansion and contraction and be less affected by sea water.

MIXING. How to Design a Concrete Mix. Concrete, vol. 30, no. 4, Apr. 1927, pp. 13-16, 2 figs. Reason for designed mixes; determining amount of water; what slump to use; fineness modulus defined; easy way to determine fineness modulus and work out nominal mix; "field mix"; final precautions.

CONCRETE CONSTRUCTION

HIGH-EARLY-STRENGTH. High-Early-Strength Concrete Speeds Stadium Building. Eng. News-Rec., vol. 98, no. 12, Mar. 24, 1927, pp. 492-494, 5 figs. Form removal possible in half usual time by adding bag of cement per batch and highly mechanized concrete control contributory element of speed.

CONDENSERS, STEAM

HEAT TRANSFER. Surface Condenser Heat Transfer, W. J. Daná. Power, vol. 65, no. 16, Apr. 19, 1927, pp. 584-586, 5 figs. Factors concerning coefficient of heat transfer; author attempts to correlate principal factors and proposes solutions which include several ideas that are new.

CONVERTERS

SYNCHRONOUS. Synchronous Converters. Am. Inst. Elec. Engrs., no. 8, Aug. 6, 1926, 13 pp. Service conditions; definitions; rating, heating; momentary load, commutation, power-factor and overspeed limitations; efficiency determined by measurement of input and output; dielectric strength test; insulation resistance; voltage regulation; direction of rotation, phase.

CONVEYORS

INDUSTRIAL APPLICATION. The Industrial Application of Conveyor Systems, C. A. Burton. Mech. Eng., vol. 49, no. 4, Apr. 1927, pp. 355-356. Basic law of economics; general types of machines; materials-handling equipment in laundry industry; effect on growth of laundry industry. See also discussion of this paper and one by H. V. Coes (published in mid-Nov. 1926 issue of Journal), pp. 356-359.

RECIPROCATING. New Type of Reciprocating Conveyor. Indus. Mgmt. (Lond.), vol. 14, no. 4, Apr. 1927, p. 126. This system carries its own electric motor beneath and attached to trough which imparts its motions by new method; conveyor is German invention by Dr. Heymann; entire trough is caused to oscillate in such way that every portion of trough bottom describes very shallow ellipse; advantages of new method.

COPPER

ELECTROLYTIC REFINING. The Specific Resistivity of Copper Refining Electrolytes and Method of Calculation, S. Skowronski and E. A. Reinoso. Am. Electrochem. Soc.—Advance Papers, Apr. 28-30, 1927, no. 11, 18 pp. Specific resistivity of sulphur acid at different concentrations and at various temperatures was determined; effect of addition of various amounts of copper, nickel, arsenic and iron on specific resistivity of sulphuric acid was studied and from results obtained it was found that within limits of composition of electrolyte used in copper refining, effect of copper, nickel, arsenic and iron on increasing specific resistivity of electrolyte is directly proportional to amounts added.

COPPER ALLOYS

CORSON. Copper Hardened by New Method, M. G. Corson. Brass World, vol. 23, no. 3, Mar. 1927, pp. 77-79, 3 figs. What Corson alloys are; stronger cable wire possible; many uses suggested; silicon-aluminum and silver-silicon alloys.

CORROSION

REFRIGERATING INDUSTRY. Corrosion in the Refrigerating Industry, R. P. Russell, J. K. Roberts and E. L. Chappell. Refrig. Eng., vol. 13, no. 7, Jan. 1927, pp. 209-217, 13 figs., and (discussion) 217-219. Corrosion in brine systems; laboratory work; plant tests; corrosion in condenser systems; recommendations for treatment and instructions for application made by Committee.

CRUSHED STONE

SEWAGE FILTERS. Crushed Stone for Sewage Filters, G. B. Gascoigne. Pit & Quarry, vol. 13, no. 12, Mar. 16, 1927, pp. 57-60. Limestone, granite, trap rock, slag, gravel and other similar materials when used only as filtering material in sewage filters, and particularly trickling filters.

CUPOLAS

PRACTICE. Hints on Cupola Practice. Foundry Trade Jl., vol. 35, no. 552, Mar. 17, 1927, pp. 233-235, 4 figs. Common difficulties dealt with.

STEEL-SCRAP MELTING. The Melting of Steel Scrap in Cupolas (A propos de la Fusion des Riblons d'acier au Cubilot), M. Guédras. Fonderie Moderne, vol. 21, Feb. 1927, pp. 35-36. Remarks based on article in Oct. 1926 issue of same journal.

CUTTING TOOLS

ROUGH TURNING. Rough Turning with Particular Reference to the Steel Cut, H. J. French and T. G. Digges. Mech. Eng., vol. 49, no. 4, Apr. 1927, pp. 339-352 and (discussion) 352-354, 17 figs. Tests extend to current commercial high-speed tool and structural alloy steels portions of Taylor's original investigations in rough turning carbon steels made primarily to show effect upon tool performance of variation in chemical composition and mechanical properties of steel cut. See reference to complete article in Eng. Index 1926, p. 224.

D

DIES

CLASSIFICATION. Classifying Dies in Stamping Shop, P. J. Edmonds. Forging—Stamping—Heat Treating, vol. 13, no. 3, Mar. 1927, pp. 87-88. Extended outline of general division of dies with further subdivision in detail; terms employed are defined.

DIESEL ENGINES

SUPERCHARGING. Diesel Engines with Scavenging and Fuel Injection by Exhaust-Gas Turbo-Blowers (Moteurs Diesel avec balayage et alimentation par turbosoufflante à gaz d'échappement), A. Buchi. Génie Civil, vol. 90, no. 7, Feb. 12, 1927, pp. 161-164, 6 figs. Results of tests carried out by Swiss Society for Locomotive and Machine Construction (S.L.N.), in collaboration with Brown, Boveri & Co., on fuel injection of internal-combustion engines; main feature of these tests is that pressure of injection greatly exceeds limits heretofore attempted, and turbo-blower employed for injection is driven by exhaust gas from engine; tests were carried out on 4-cylinder, 4-stroke engine.

DRILLS

TWIST. An Investigation of Twist Drills, B. W. Benedict and A. E. Hershey. University of Ill.—Bul., vol. 24, no. 11, Nov. 16, 1926, 76 pp., 29 figs.

DYNAMOMETERS

TRANSMISSION. A Simple Transmission Dynamometer, J. C. Oakden. Engineering, vol. 123, no. 3191, Mar. 11, 1927, p. 291. Installed in laboratories of Municipal College of Technology, Manchester, to measure power output of small De Laval steam turbine.

ELECTRIC FURNACES

ELECTROTHERMIC PROCESSES. The Use of Electric Furnaces at Niagara Falls, 1902 to 1926, F. A. J. FitzGerald. Am. Electrochem. Soc.—Advance Paper, no. 2, for mtg. Apr. 28-30, 1927, pp. 47-50, 3 figs. Presents figures showing remarkable growth of furnaces used in certain electrothermic processes in Niagara Falls during 25 years; electric-furnace processes are divided into three groups, namely: abrasives, carbon products and ferro-alloys and calcium carbide.

HEAT-TREATING. Tubular Electric Furnace for Heat Treating, H. O. Swoboda. Forging—Stamping—Heat Treating, vol. 13, no. 3, Mar. 1927, pp. 96-97, 1 fig. Embodies radical departure from prevalent pusher type.

INDUSTRIAL APPLICATIONS. Electricity in Industrial Heating. Iron Age, vol. 119, no. 13, Mar. 31, 1927, pp. 918-919. Heat-treating departments need improving; forging furnaces have faults; advantages in melting grey iron and brass electrically.

NON-FERROUS. Electric Furnaces for Non-Ferrous Metals. Metallurgist (Supp. to Engineer), Mar. 25, 1927, pp. 35-36. Review of papers and discussion presented before Institute of Metals.

E

ELECTRIC GENERATORS, A.C.

EXCITERS FOR. Exciters for A.C. Generators. Power Plant Eng., vol. 31, no. 7, Apr. 1, 1927, pp. 415-417, 2 figs. Compound versus shunt type; capacity needed for various generators; methods of control.

SYNCHRONOUS. Transverse Reaction in Synchronous Machines, J. F. H. Douglas. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 2, Feb. 1927, pp. 109-115, 7 figs. Confusion existing in theory of synchronous machines is shown to be due to insufficient experimental evidence of behaviour of this type of machine under transverse-magnetizing (cross magnetizing) conditions; method of testing which yields needed data is described; results of these tests on particular machine; it is proved that effect of transverse reaction can be most accurately estimated by use of magnetomotive force diagram.

QUICK-RESPONSE EXCITATION. Quick-Response Excitation for Alternating-Current Synchronous Machinery, C. A. Powell. Elec. Jl., vol. 24, no. 4, Apr. 1927, pp. 157-162, 10 figs. System with which it has been found possible to restore induced voltage in synchronous machine within fraction of second for considerable load changes and line to neutral faults; consists of high-speed voltage regulator connected to generator terminals through positive sequence network, and exciter designed with two or more parallel paths in its field to reduce its inductance.

ELECTRIC CURRENTS

TRANSIENTS. Electric Transients and Engineering Fundamentals, E. C. Magnusson and G. S. Smith. Elec. World, vol. 89, no. 15, Apr. 9, 1927, pp. 749-751, 9 figs. Discussion of transient electric phenomena, illustrated by examples and oscillograms; attention called to trend toward greater emphasis on engineering fundamentals.

ELECTRIC MOTORS, A.C.

SYNCHRONOUS. Synchronizing Power in Synchronous Machines. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 4, Apr. 1927, pp. 380-385, 6 figs. Discussion of paper by M. Putnam published in Dec. 1926 issue of Journal. See reference to original article in Aug. Index 1926, p. 276.

ELECTRIC MOTORS

CIRCUIT FORMULAS. Graphic Solution of Motor Circuits, M. Kushlan. Elec. World, vol. 89, no. 13, Mar. 26, 1927, pp. 650-653, 2 figs. Short method of determining current taken by motors for varying conditions of loading and power factor by use of chart based on motor circuit formulas and tables.

ELECTRIC MOTORS, D.C.

CONTROL. Type M.T. Control for D.C. Motors. Iron & Steel of Canada, vol. 10, no. 3, Mar. 1927, pp. 54-58, 7 figs. Although mill-type control system was originally developed for use in connection with motors driving steel mill auxiliaries, its field has been expanded to include control of crane bridge, trolley and hoist motors, coal and ore bridges and many other applications; vital principle of system rests in method by which proper timing of accelerating contractors is obtained; auxiliary control; crane-motor control; acceleration of inertia loads.

STARTING. Series Contactors Applied to Starting Direct-Current Motors, C. N. McDavitt. Power, vol. 65, no. 13, Mar. 29, 1927, pp. 473-475, 5 figs. Operation of one type of series contactor and its applications are discussed.

ELECTRIC MOTORS, INDUCTION

POLYPHASE. Operation and Maintenance of Polyphase Induction Motors, W. R. Bowker. South. Power Jl., vol. 45, no. 4, Apr. 1927, pp. 40-47. 11 figs. Practical information regarding wiring and running.

ELECTROMAGNETS

CALCULATION. Calculation of D.C. Electromagnets (Tableau des formules utiles pour le calcul des électro-aimants à courant continu), M. Mathieu. Arts et Métiers, vol. 80, no. 76, Jan. 1927, p. 29. Presents table of formulas.

ELECTRIC TRANSMISSION LINES

GROUND FAULTS. Characteristics of Ground Faults on Three-Phase Systems, S. B. Griscom. Elec. Jl., vol. 24, no. 4, Apr. 1927, pp. 151-156, 12 figs. Application of method of symmetrical co-ordinates to study of ground faults greatly simplifies calculation of ground currents, and also facilitates study of other phenomena, such as power loss, voltage and current division.

SAG. Sag Calculations for Power Transmission Lines, W. T. Taylor. Elec. Rev., vol. 100, nos. 2570, 2571 and 2572, Feb. 25, Mar. 4 and 11, 1927, pp. 290, 334-336 and 379-380. Consideration of requirements for overhead conductors under varying working conditions due to change in temperature, wind pressure, ice coving, etc.

VOLTAGE SURGES. Transmission Line Voltage Surges, J. H. Cox. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 3, Mar. 1927, pp. 263-271, 9 figs. Records of transients actually occurring on transmission lines of widely varying characteristics have been obtained with klydonograph; they substantiate many theories of transients on lines, indicate incorrectness or incompleteness of some theories, and suggest modifications or extensions of these latter theories. Bibliography.

ELECTRIC WELDING, ARC

BUILDING CONSTRUCTION. Wide New Field Opens for Welding, G. E. Hagemann. Mfg. Industries, vol. 13, no. 3, Mar. 1927, pp. 215-216, 4 figs. Westinghouse puts up large five-storey building by arc-welding process; advantages offered through medium of welded construction.

BUTT-WELDING MACHINE. Lincoln Carbon-Arc Butt-Welding Machine. Am. Mach., vol. 66, no. 14, Apr. 7, 1927, p. 599, 1 fig. Recent development of Lincoln Electric Co., Cleveland, O.; it is claimed that this welder can be applied to certain classes of butt-welding problems that cannot be handled on resistance welder.

STUDY OF. Study of Electric Autogenous Welding (Etude sur la soudure électrique autogène), H. Dustin. Revue Universelle des Mines, vol. 12, no. 5, Dec. 1, 1926, pp. 177-206, 22 figs. Results of research including study of structure and mechanical properties of welding metal and action of welding on basic metal.

ENGINEERING

MILITARY. The Effect of Mechanicalization of the Army on the Organization and Employment of Divisional and Corps Engineers in the Field, H. P. W. Hutson. Royal Engrs. Jl., vol. 41, no. 1, Mar. 1927, pp. 1-34. War and mechanicalization; process of mechanicalizing army; function of engineers in army; improvised, partial and full mechanicalization.

EXPLOSIVES

TAMPING. Tamping Explosives, C. S. Hurter. Eng. & Contracting, vol. 66, no. 3, Mar. 1927, p. 101, 3 figs. Tongs for making dummy clay cartridges.

USE OF. Notes on the Use of Explosives. Can. Min. Jl., vol. 48, no. 11, Mar. 18, 1927, pp. 233-234. Thawing; strength and relative strength.

EVAPORATORS

HEAT TRANSMISSION. Heat Transmission in Evaporating Apparatus, T. Shipley. Power Plant Eng., vol. 31, no. 8, Apr. 15, 1927, pp. 472-475, 5 figs. Results of two years' work of York Mfg. Co.; factors affecting heat transmission in evaporating apparatus; methods of increasing heat-transfer rates; results of accurate tests on shell and tube coolers and special pipe coils.

F

FANS

CEILING. Testing of Ceiling Fans, E. Hughes and W. G. White. Instn. Elec. Engrs.—Jl., vol. 65, no. 363, Mar. 1927, pp. 367-372, 13 figs. Tests to determine influence upon measured volume of air of (1) distance of plane of observation below fan blades; (2) position of fan in, and size of, room; (3) height of fan above floor; (4) distance between fan and ceiling; (5) room temperature; (6) speed of fan; recommendations are made relating to conditions under which air velocities should be observed.

FEEDWATER HEATERS

LOCOMOTIVES. Feedwater Heaters on Locomotives, V. L. Jones. New England Railroad Club—Proc., Feb. 8, 1927, pp. 254-265 and (discussion) 265-276.

FLOW METERS

TYPES. The Metering of Fluids, H. M. Brown. Indus. Chemist, vol. 3, no. 26, Mar. 1927, pp. 128-132, 11 figs. Discusses different types of meters.

FLOW OF AIR

DUCTS. Experiments on the Flow of Air in Ducts, W. E. Cooke and I. C. F. Statham. Iron & Coal Trades Rev., vol. 114, nos. 3078, 3079 and 3080, Feb. 25, Mar. 4 and 11, 1927, pp. 320-321, 356 and 394-395, 12 figs. See also Colliery Guardian, vol. 133, no. 3452, Feb. 25, 1927, pp. 441-443, 8 figs.

FILTRATION PLANTS

RAPID-SAND. New Filter Plant at St. Lambert, Que., R. DeL. French. Can. Engr., vol. 52, no. 12, Mar. 22, 1927, pp. 363-365, 6 figs. Mechanical rapid-sand plant will have capacity of 2,400,000 gal. per day; pumping plant comprises 2 low-lift and 3 high-lift motor-driven and standby units; design of filter underdrainage system.

FORESTRY

EDUCATION. Problems in Forest Education. Jl. of Forestry, vol. 25, no. 3, Mar. 1927, pp. 290-324. Report of Committee on Forest Education; graduate work in forestry; summary of comments by subcommittee; research in forest schools; vocational education in forestry; education in forest products; non-professional courses and extension work; extension work in colleges; education of general public.

FORGING

HOT AND COLD. British and American Practice in the Working of Hot and Cold Metals, F. W. Spencer. Roy. Soc. of Arts—Jl., vol. 75, no. 3879, Mar. 25, 1927, pp. 438-450 and (discussion) 450-456, 9 figs.

STEEL. Some Notes on the Forging of Steel, O. W. Ellis. Metallurgist (Supp. to Engineer), Mar. 25, 1927, pp. 46-47.

MACHINE. Progress in Machine Forging, C. D. Harmon. West. Machy. World, vol. 17, no. 12, Dec. 1926, pp. 534-535, 10 figs. and vol. 18, no. 2, Feb. 1927, pp. 64-65 and 91. Comparison of relative merits of machine forging and drop-forging operations.

FURNACES, ANNEALING

GAS-FIRED. Modern Gas-Fired Annealing Furnaces, T. Teisen. Foundry Trade Jl., vol. 35, no. 552, Mar. 17, 1927. pp. 238-239. Suiting producer to fuel; regenerative and recuperative furnaces; malleable annealing furnaces.

FURNACES, HEAT-TREATING

DESIGN. Practical Industrial Furnace Design, M. H. Mawhinney. Forging—Stamping—Heat Treating, vol. 13, no. 3, Mar. 1927, pp. 83-86 and 88, 2 figs. Construction of furnaces for heat-treating plays important part in success of operation; heating processes are explained by examples.

TYPES. Heat Treatment and Metallography of Steel, H. C. Knerr. Forging—Stamping—Heat Treating, vol. 13, no. 3, Mar. 1927, pp. 103-107 and 110, 3 figs. Furnace materials; essentials for good heating; types of furnaces; electric furnaces.

FURNACES, HEATING

REVERSIBLE REGENERATION. The Influence of Flue Gas Temperature Upon Fuel Consumption. Metal Industry (Lond.), vol. 30, no. 9, Mar. 4, 1927, pp. 238-239, 2 figs. Attempt has been made during past few years by Davis Furnace Co., Luton, to reduce heat losses on gas-fired furnaces by adoption of system of reversible regeneration applied to air supply; design of furnace in which this principle is adopted is known as Revergen; advantages of system; typical results available upon annealing of cast iron and steel in furnaces of Revergen type.

FURNACES, MELTING

CRUCIBLE STEEL. Practical Crucible Steel Melting, J. F. Kayser. Iron & Coal Trades Rev., vol. 114. nos. 3080 and 3081, Mar. 11 and 18, 1927, pp. 396-397 and 438-439, 1 fig. Deals with coke-fired and producer-gas crucible-steel furnaces; runners are divided into two categories: (1) defects in pot when it leaves pot house; (2) defects developed in furnace; cause of runners; crucible-steel ingots.

G

GAUGES

INTERCHANGEABLE WORK. Gauging and Interchangeability, F. C. Hudson. Am. Mach., vol. 66, no. 14, Apr. 7, 1927, pp. 575-576. Gauges necessary to secure interchangeable work; confusion of "limits" and "tolerance"; advantages of unilateral tolerances in manufacturing; difference between selective and interchangeable manufacture.

GASOLINE

Blending with Benzol. Effect of Blending Gasoline with Benzol, C. W. Stevens. Power Plant Eng., vol. 31, no. 8, Apr. 15, 1927. p. 459, 3 figs. Distorted diagram permits of ready discernment of knocking action in internal-combustion engines.

GEAR CUTTING

Internal Clutch Teeth. Fellows Attachment for Cutting Internal Cluth Teeth. Machy. (N.Y.), vol. 33, no. 8, Apr. 1927, pp. 621-623, 3 figs. Improved method of machining clutch gears having hubs that are flush with face or extend beyond it, developed by Fellows Gear Shaper Co.; involves use of "side-trimming" gear shaper cutter which completes teeth in clutch after they have been roughed out by drilling.

GEARS

Hypoid, for Rear Axles. Design, Production and Application of the Hypoid Rear-Axle Gear. Soc. Automotive Engrs.—Jl., vol. 20, no. 4, Apr. 1927, pp. 464-467. Discussion of paper by A. L. Stewart and E. Wildhaber printed in June 1926 issue of Journal. See reference to original article in Eng. Index 1926, p. 364.

GRINDING

Centreless. Round Bars Finished by Centreless Grinding, J. E. Caster. Iron Age, vol. 119, no. 13, Mar. 31, 1927, pp. 927-929 and 978, 8 figs. Surface defects removed and bars ground true to size within 0.0005 in.; use of process extended to 4-in. diameter stock.

Shafts. Cut Costs in Grinding Shafts, H. Rowland. Abrasive Industry, vol. 8, no. 4, Apr. 1927, pp. 114-115, 4 figs. How wide-wheel grinding is employed in finishing shafts for electric motors; novel design of work racks are used.

GRINDING MACHINES

Surface. Vertical Spindle Surface Grinder. Machy. (Lond.), vol. 29, no. 754, Mar. 24, 1927, pp. 806-807, 3 figs. Thirteen and three-quarter-inch magnetic-table grinding machine is product of Schuchardt & Schütte A. G., Berlin.

H

HARDNESS

Rockwell and Brinell Numbers. Relationships Between the Rockwell and Brinell Numbers, S. N. Petrenko. U.S. Bur. Standards—Technologic paper, no. 334, Jan. 10, 1927, pp. 195-222, 7 figs.

HEAT TRANSMISSION

Steam to Fuel Oil. The Heat Transfer from Steam to Heavy Fuel Oil, G. R. McCormick and H. Diederichs. Sibley School Mech. Eng., Eng. Experiment Station—Bul., no. 7, Feb. 1, 1927, 22 pp., 11 figs. Results of tests using heavy Mexican crude oil.

HEATING, HOT WATER

Expansion and Air Venting. Expansion and Air Venting, C. L. Hubbard. Sanitary & Heat. Eng., vol. 106, no. 3, Mar. 1927, pp. 184-186 and 188, 8 figs. How air accumulates in hot water heating system and various methods adopted for freeing system from air and providing for expansion.

HIGHWAYS

Maintenance. Measuring Maintenance Efficiency by Unit Costs, W. H. Connell. Eng. News-Rec., vol. 98, no. 12, Mar. 24, 1927, pp. 490-491. Upkeep costs compared by administration units from divisions to single patrols on Pennsylvania roads.

HYDRAULIC TURBINES

Design. Modern Practice in the Construction of Hydro-Electric Power Machinery (Les tendences actuelles en construction hydrotechnique). Technique Moderne, vol. 19, no. 2, Jan. 15, 1927, pp. 39-47, 18 figs.

Improvements. Improvements in Construction of Hydraulic Turbines (Importantes progresos en la construction de turbinas hidraulicas), F. Grübler. Sociedad de Fomento Fabril—Bul., vol. 43, no. 9, Sept. 1926, pp. 637-638. Kaplan helicoidal turbine and improvements made in free-flow turbines for high heads.

HYDRO-ELECTRIC DEVELOPMENTS

Ontario. Norman Dam Power Development. Elec. News, vol. 36, no. 7, Apr. 1, 1927, pp. 32-34, 7 figs. Five 3,300-kvs. generators of Keewatin Power Co. supply energy at 6,600 volts for grinder motors of paper mills.

Winnipeg River, Canada. Power Development on the Winnipeg River. Contract Rec., vol. 41, no. 12, Mar. 23, 1927, pp. 293-294. By close of 1927 plants will have installed capacity of 250,000 h.p.

HYDRO-ELECTRIC PLANTS

Quebec. Hemmings Falls Development, J. S. H. Wurtele and H. S. Grove. Elec. News, vol. 36, no. 6, Mar. 15, 1927, pp. 27-32, 10 figs. Also Contract Rec., vol. 41, no. 13, Mar. 30, 1927, pp. 306-311, 10 figs. 36,000-kva. on St. Francis river a revitalizing force in eastern townships of Quebec province; design of dam, spillway and sluiceways; waterways.

Water Storage. Problems of Economic Water Storage, P. Ogilvie. Can. Engr., vol. 52, no. 13, Mar. 29, 1927, pp. 381-383, 5 figs. Factors that must be taken into consideration when calculating water storage for generation of hydro-electric power; amount of storage and horsepower available from Coulonge river watershed calculated from government run-off reports.

I

INDUSTRIAL MANAGEMENT

Manager, Influence of. The First Step in Industrial Organization, A. H. Church. Mfg. Industries, vol. 13, no. 3, Mar. 1927, pp. 217-219. Critical discussion of statement in recent article by L. P. Alford, read before Am. Soc. of Mech. Engr., that "Wise leadership is more essential to successful operation than extensive organization or perfect equipment"; in author's opinion, industrial problem, and that of management in particular, is in danger of becoming altogether too mechanical; devolution and not evolution is law that controls expansion of industrial unit; result of devolution process; in order to erect comprehensive science of management, this peculiar and central influence of manager that permeates the whole must be kept steadily in mind.

INDUSTRIAL PLANTS

Fuel Economy in. A Study in Heat Generation with Suggestions for Eliminating Waste, F. M. Gibson. Indus. Mgmt. (N.Y.), vol. 73, no. 3, Mar. 1927, pp. 177-183, 6 figs. Author states that nine-tenths of ton of coal are lost in generating heat in modern industrial plant for each ton actually applied to production; discusses means such as insulation and use of sufficient power generating apparatus, which will reduce this large loss to a minimum.

INSULATION, HEAT

Materials. Heat Insulation, J. S. F. Gard. Chem. & Industry, vol. 46, no. 12, Mar. 25, 1927, pp. 101T-105T, 2 figs.

INTERNAL-COMBUSTION ENGINES

Bearing Loads. Engine Bearing Loads. Automobile Engr., vol. 17, no. 226, Mar. 1927, pp. 96-98, 4 figs. Loads of big-end bearing are due to three causes; fluid forces, inertia forces produced by reciprocating parts, and centrifugal force of rotating portions of big end; conditions of loading; variation of load with speed; weight reduction and increased speed; bearing loads and factors.

Flame Spectrography. Spectrography of Flames in a Combustion Engine (Spectrographie de flammes dans un moteur à explosion), A. Henne and G. L. Clark. Académie des Sciences—Comptes Rendus, vol. 184, no. 1, Jan. 4, 1927, pp. 26-28.

Supercharging. Evolution of Internal-Combustion Motors Towards Compound Working (L'évolution du moteur à combustion interne vers la machine compound). Technique Moderne, vol. 19, no. 2, Jan. 15, 1927, pp. 57-59, 2 figs.

See also Diesel Engines.

IRON

Rustless. Rustless Iron by a New Process. Iron Age, vol. 119, no. 14, Apr. 7, 1927, pp. 990-992, 3 figs. Novel method of melting developed in Sweden; electrodes of ferrochromium suggested; chromium losses reduced; carbon increases kept down.

IRON CASTINGS

Production. Iron Castings and Their Production, H. Allen. Commonwealth Engr., vol. 14, no. 6, Jan. 1, 1927, pp. 225-228.

Warping. Prevent Castings from Warping. Foundry, vol. 55, no. 8, Apr. 15, 1927, p. 297. Theories and remedies for cause and cure of warped castings.

IRON DEPOSITS

Manganiferous. Reserves of Lake Superior Manganiferous Iron Ores. C. Zapffe. Am. Inst. Min. & Met. Engrs.—Trans., no. 1664-C, May 1927, 23 pp., 3 figs. Uses, analyses and occurrences of ores, tonnage estimates; judging prospective future annual consumption, offering tonnage estimate of reserves, and then deciding whether this estimated reserve of manganiferous ore will last as long as known estimated reserve of iron ore.

L

LABOUR

Stabilizing Employment. Stabilizing Employment by an Elastic Work-Day, L. F. Loree. Indus. Mgmt. (N.Y.), vol. 73, no. 3, Mar. 1927, pp. 129-134. Unique plan for regulating working hours to conform with fluctuations in business; it is quite evident that elastic day varying between limits of eight and ten hours can be used to stabilize employment.

LIGHTING

Street. Clock Controls Street Lights Automatically. Elec. World, vol. 89, no. 12, Mar. 19, 1927, p. 609, 1 fig. New street-lighting system in St. Louis will be turned on and off automatically at sunset and sunrise by astronomical clock-operated relays which compensate for seasonal variations in night and day.

LOCOMOTIVE BOILERS

Nickel-Steel Shells. Locomotive Boilers with Nickel-Steel Shells. Ry. Mech. Engr., vol. 101, no. 4, Apr. 1927, pp. 196-200, 9 figs. Permits 25 per cent increase in pressure on Canadian Pacific's new 4-6-2 and 4-8-2 types.

LOCOMOTIVES

Coaling Stations. Large Coaling Station Embodies New Features. Ry. Age, vol. 82, no. 17, Mar. 26, 1927, pp. 998-999, 4 figs. Norfolk & Western plant at Portsmouth, O., has storage capacity of 2,000 tons in two bins.

Construction. Precision Methods in Steam Locomotive Construction, W. Massmann. AEG Progress, vol. 2, no. 8, Aug. 1926, pp. 172-176, 1 fig.

Internal-Combustion Boilers. The Internal-Combustion Boiler and the Locomotive. Ry. Engr., vol. 48, no. 566, Mar. 1927, p. 97. Operation of internal-combustion boiler; claims in regard to locomotive application; besides being able to reduce fuel consumption by 50 per cent and retaining reciprocating steam engine, many further advantages are obtained in using submerged flames for generating steam.

Packings. Locomotive Packings. Ry. Engr., vol. 48, no. 567, Apr. 1927, pp. 158-159, 3 figs. Details of new metallic segmental type of proved efficiency.

Performance. Locomotive Performance and Its Influence of Modern Practice, E. C. Poultney. Ry. Engr., vol. 48, no. 567, Apr. 1927, pp. 132-134, 5 figs.

Propellers. A Comparative Study of Different Methods of Propulsion, F. Corini. Int. Ry. Congress—Bul., vol. 9, no. 3, Mar. 1927, pp. 187-192, 2 figs.

LUBRICANTS

Economic Use of. Economic Use of Lubricants in Machine Shops (Aufwendungen für Schmiermittel und Möglichkeiten ihrer Verringerung in Maschinenfabriken), K. Seyderhelm. Maschinenbau, vol. 6, no. 5, Mar. 10, 1927, pp. 219-220, 1 fig. Gives examples of wasteful use of lubricants in machine shops, and discusses possibilities of effecting economies through constructional improvements and supervision.

Greases. Lubricating Greases and Soluble Oils, A. Seton. Machy. (Lond.), vol. 29, no. 754, Mar. 2, 1927, pp. 805-806. Requisites for good grease for lubrication are (1) freedom from acidity, particularly due to mineral acid; (2) mineral matter very low, and not of abrasive character; (3) viscosity well maintained and constituents not separating when grease melts.

LUBRICATING OILS

Study of. A Study of Petroleum Lubricants, C. F. Mabery. Indus. & Eng. Chem., vol. 19, no. 4, Apr. 1927, pp. 526-529.

M

MACHINE TOOLS

Electric Drive. Designs Simplified by Electrical Means, H. L. Blood. Machy. (N.Y.), vol. 33, nos. 7 and 8, Mar. and Apr. 1927, pp. 481-484 and 585-589, 12 figs. Examples of simplification of machinery by use of motor drives and electrical controlling apparatus.

Modern. Modern Machine Tool, H. Rowland. Can. Machy., vol. 37, no. 12, Mar. 24, 1927, pp. 15-17, 7 figs. Modern machine tools are equipped with better control, can take heavier cuts, give more accurate work with less effort, in fact, make it possible to employ cheaper labour where desirable.

MATERIALS HANDLING

Industrial Plants. Transport in the Engineering Works, H. Bentley. Indus. Mgmt. (Lond.), vol. 14, no. 4, Apr. 1927, pp. 135-136. Points out that introduction of well-planned runway or truck system means elimination of considerable amount of waste time in plant: electric vehicles and travelling cranes; mobility of electric truck and platform truck.

LIME INDUSTRY. Materials Handling Methods in the Lime Industry, E. J. Tournier. Indus. Mgmt. (N.Y.), vol. 73, no. 3, Mar. 1927, pp. 151-154, 6 figs. Analysis shows that in most cases regular manufacturing schedule can be established; in author's opinion, there is no reason why lime plant cannot be made a factory, producing regular output with minimum of hand labour; examples of economies effected by introduction of machinery to reduce labour costs.

PNEUMATIC. Recent Developments in the Pneumatic Handling, E. J. Tournier. Indus. Mgmt. (N.Y.), vol. 73, no. 4, Apr. 1927, pp. 205-209, 6 figs. Construction and operation of newer types of pneumatic conveyors.

METALS

CORROSION FATIGUE. Stress-Strain-Cycle Relationship and Corrosion-Fatigue of Metals, D. J. McAdam, Jr. Am. Soc. Testing Matls.—Proc., vol. 26, part 2, 1926, 40 pp., 12 figs.

FATIGUE. Some Modern Views on the Fatigue of Metals, H. J. Gough. Structural Engr., vol. 5, no. 3, Mar. 1927, pp. 70-81 and (discussion) 81-83, 7 figs.

GRAIN GROWTH. Relation of Surface to Volume in Crystals as a Determining Factor in Grain Growth of Metals, G. W. Walker. Am. Soc. Steel Treating—Trans., vol. 11, no. 4, Apr. 1927, pp. 619-625.

SUPERHEATED STEAM, EFFECT OF. Why Metals Fail Under Influence of Steam Once Superheated, B. Houghton and D. C. Weeks. Power, vol. 65, no. 15, Apr. 12, 1927, pp. 540-542, 7 figs. Presents deductions on cause of metal failures from observations extending over a period of 30 years of power-plant practice combined with recent observations of nature of superheated steam as produced in modern power plants.

MICROSCOPES

UNIVERSAL MEASURING. Universal Measuring Microscope. Machy. (Lond.), vol. 29, no. 752, Mar. 10, 1927, p. 753, 3 figs. Latest addition to range of Schuchardt & Schütte Zeiss fine measuring tools; wide range of application includes accurate measurement of screw threads by aid of straight edges applied to tooth profile on axial plane of thread.

MILLING

AUTOMOBILE COMPONENTS. Modern Milling Practice. Automobile Engr., vol. 17, no. 226, Mar. 1927, pp. 103-105, 8 figs. Typical quantity-production methods for automobile components.

MILLING MACHINES

STANDARDIZED SPINDLE END. Announce Standardized Spindle End. Iron Age, vol. 119. no. 13, Mar. 31, 1927, pp. 930-931 and 978, 6 figs. Milling-machine manufacturers adopt common design, which promises economies for users; complete set of new arbors developed. See also Iron Trade Rev., vol. 80, no. 13, Mar. 31, 1927, pp. 821-823, 5 figs., and Am. Mach., vol. 66, no. 13, Mar. 31, 1927, pp. 517-521, 10 figs.

Standardized Arbors for Milling Machines. Machy. (N.Y.), vol. 33, no. 8, Apr. 1927, p. 576A, 3 figs. Standard adopted by Milling Machine Manufacturers of National Machine Tool Builders' Association.

MINE TIMBERING

PRESERVATION. Progress in Mine Timber Preservation in U.S. and Europe, G. M. Hunt. Min. Congress Jl., vol. 13, no. 4, Apr. 1927, pp. 270-275, 5 figs. Report of Timber Preservation Committee shows progress in mine timber preservation during 1926; special investigation conducted on preservation and treatment in Central Europe.

MINERAL INDUSTRY

ONTARIO. Mineral Production of Ontario, 1926, W. R. Rogers and A. C. Young. Can. Min. Jl., vol. 48, no. 14, Apr. 8, 1927, pp. 283-287. Production statistics.

QUEBEC. Quebec's Mineral Production in 1926. Can. Min. Jl., vol. 48, no. 13, Apr. 1, 1927, pp. 264-265. Preliminary statement of production.

MINES

BRITISH COLUMBIA. Mining in British Columbia, R. W. Haggen. Compressed Air Mag., vol. 32, no. 4, Apr. 1927, pp. 1992-1996, 11 figs. Besides Sullivan and other silver-lead mines, southwestern portion of province contains vast beds of coking coal; in central section there are number of gold, silver, copper, lead and zinc showings.

MINING

NOVA SCOTIA. Mining in Nova Scotia in 1926, G. S. Harrington. Can. Min. Jl., vol. 48, no. 13, Apr. 1, 1927, pp. 270-272. Review of annual report upon mines of province.

UNDERGROUND. Underground Practice in Mining, B. Beringer. Min. Mag., vol. 36, no. 3, Mar. 1927, pp. 152-158, 1 fig. Main principles underlying efficient mining practice, with special reference to efficiency in machine stoping.

MOLYBDENUM

MOLYBDITE FROM ORE. Recovery of Molybdite from the Ore, H. A. Doerner. U.S. Bur. Mines—Tech. Paper, no. 399, 1926, 13 pp., 1 fig. Use of molybdenum; molybdenum minerals; possible methods of recovering molybdite, including flotation, gravity concentration, dielectric concentration, leaching and distillation with chlorine.

MOTOR-BUS TRANSPORTATION

CO-ORDINATION WITH RAILWAYS. Pacific Electric Co-ordinates Rail and Bus Service. Ry. Age, vol. 82, no. 17, Mar. 26, 1927, pp. 1021-1023, 5 figs. Railway organization handles operation and maintenance of 114 coaches which have replaced train service.

FIELDS FOR. Fields for Motorcoach Operation, R. N. Graham. Soc. Automotive Engrs.—Jl., vol. 20, no. 4, Apr. 1927, pp. 489-497, 6 figs. and (discussion) 497-501. Definition of fields for profitable operation of motor coaches is undertaken by author on basis of personal experience in concurrent operation of motor coaches and street railways during last five years; fields in which motor coaches can be operated profitably are specified, and author advocates special supplemental service for which relatively high rates of fare may be charged for comfortable express ride from suburbs into heart of city.

MOTOR BUSES

ALL-METAL. All-Metal Omnibus Bodies. Motor Transport, vol. 44, no. 1149, Mar. 21, 1927, pp. 343-345, 7 figs. Progress made by Short Bros. with novel construction of light alloys; extreme lightness combined with strength.

MAINTENANCE. Motorcoach Maintenance Methods, H. L. Debbink. Soc. Automotive Engrs.—Jl., vol. 20, no. 4, Apr. 1927, pp. 454-456 and (discussion) 456-459.

TESTING. Major Testing by Electricity. Bus Transportation, vol. 6, no. 4, Apr. 1927, pp. 191-194, 10 figs. Tire life, brake adjustment, trouble shooting and performance measurements made of engine or complete vehicle, with dynamometer outfit now being introduced in operating garages.

N

NON-FERROUS METALS

TEMPERATURE DETERMINATION. Judging Temperature by Sight, R. R. Clarke. Can. Foundryman, vol. 18, no. 3, Mar. 1927, pp. 5-6. Appearance of various non-ferrous metals at various temperatures is discussed, and practical information given to enable moulder to judge actual temperature of metal under widely varying conditions.

NOZZLES

DISCHARGE. The Coefficient of Discharge of Nozzles (Note sur le coefficient de débit des tuyères), A. Schlag. Revue Universelle des Mines, vol. 13, no. 2, Jan. 15, 1927, pp. 64-74, 6 figs.

O

OIL FIELDS

ALBERTA, CANADA. The Stratigraphy and Oil Prospects of Alberta, Canada, F. H. McLearn and G. S. Hume. Am. Assn. Petroleum Geologists—Bul., vol. 11, no. 3, Mar. 1927, pp. 237-260, 4 figs. Physiography; stratigraphy; structure and oil prospects; relation of structure to oil production in Turner valley. Bibliography.

OILS

INSULATING. Oil Breakdown at Large Spacings, D. F. Miner. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 4, Apr. 1927, pp. 336-343, 12 figs. Data on several sizes of spherically terminated rods or cylinders; short-time breakdown tests are shown to be quite erratic and form of long-time test schedule was developed which gives more consistent results; final test used is called ten-minute-hold and yields values for given condition representing maximum voltage that can be held consistently.

OPEN-HEARTH FURNACES

BASIC PRACTICE. Basic Open-Hearth Practice, C. H. Herty, Jr. Am. Soc. Steel Treating—Trans., vol. 11, no. 4, Apr. 1927, pp. 569-582.

REFRACTORIES. Factors Affecting Open-Hearth Refractories, B. M. Larsen and A. Grodner. Blast Furnace & Steel Plant, vol. 15, no. 4, Apr. 1927, pp. 161-164, 10 figs. Certain relations between refractories service. insulation and flow of heat in open-hearth furnace; investigation conducted under operating conditions.

ORE TREATMENT

QUEBEC. The Ores of Western Quebec, W. B. Timm. Min. Jl., vol. 156, no. 4777, Mar. 12, 1927, pp. 225-226. Classification of ores; examples and metallurgical treatment. Report made for Can. Dept. of Mines.

OXY-ACETYLENE WELDING

STEEL CASTINGS. How Steel Castings Are Ox-welded. Oxy-Acetylene Tips, vol. 5, no. 9, Apr. 1927, pp. 164-165, 1 fig. Preparation for welding; preheating is usually necessary; welding technique; annealing.

P

PAINTS

PAINT AND VARNISH REMOVERS. Volatility of Acetone-Benzene Paint and Varnish Removers, J. M. Weiss. Indus. & Eng. Chem., vol. 19, no. 4, Apr. 1927, pp. 485-487.

PAVEMENTS

CITY TYPE FOR RURAL HIGHWAYS. Can City Type Pavement Be Used on Rural Highways? H. B. Smith. Good Roads, vol. 70, no. 3, Mar. 1927, pp. 136-137. Deals materially with sheet-asphalt construction; problem of Burlington County, N.J.; after nine years of bituminous construction, author is satisfied that selecting city type pavements for country highways has been vindicated; they are not only cheaper per mile as to first cost, but materially lower in maintenance.

PAVEMENTS, BRICK

DURABILITY. Ancient Brick Paving. Clay-Worker, vol. 87, no. 4, Mar. 1927, pp. 285-287, 4 figs. Interesting facts about durability of well-burned clay brick and its long usage.

PLANERS

POWER REQUIRED FOR DRIVE. Power Required for Planing. Am. Mach., vol. 66, no. 13, Mar. 31, 1927, p. 543. Table for calculating power required for making cuts on planers. Reference-book sheet.

PULVERIZED COAL

STEAM POWER PLANTS. Power Plant Trend Toward Lower Costs, A. Murphy. Power House, vol. 21, no. 6, Mar. 20, 1927, pp. 33-35, 5 figs. Pulverized-fuel systems finding favour in many of Dominion's larger industrial plants, although majority of installations have been operating too short a time to permit thorough analysis of costs being made.

PUMPS

AIR LIFTS. Practical Installation of the Air Lift, H. T. Abrams. Power Plant Eng., vol. 31, no. 8, Apr. 15, 1927, p. 427, 1 fig. Pipes should be submerged to certain depth, proportionate to lift when pump is at work; necessity of proper ratio of submergence to lift is important and is governing factor in design of such a pump.

PUMPS, CENTRIFUGAL

CHARACTERISTICS. Centrifugal Pumps and Their Characteristics, G. Lee. Indus. Mgmt. (N.Y.), vol. 73, no. 3, Mar. 1927, pp. 188-192, 13 figs. Features of design which influence selection and application.

THRUST AND LEAKAGE. Eliminating Thrust and Leakage in Centrifugal Pumps, J. J. Conway. Power Plant Eng., vol. 31, no. 7, Apr. 1, 1927, pp. 402-403. Adjustable wearing rings and thrust bearings are needed to keep up best efficiency.

Q

QUARRYING

PULPSTONE. Quarrying and Finishing Pulpstone, J. M. Peterson. Can. Min. Jl., vol. 48, no. 11, Mar. 18, 1927, pp. 229-230, 3 figs. Ways and means employed to work stone ledge and to support overburden, showing various steps in process used to finish stone and played by compressed air in quarrying and in dressing stone.

R

RADIOTELEGRAPHY

AMPLIFIERS. A New Development in Resistance Amplification, F. M. Colebrook. Experimental Wireless, vol. 4, no. 43, Apr. 1927, pp. 195-205, 11 figs. Analyzes in general terms operation of triode valve with very high resistance in anode circuit, illustrating analysis by reference to typical valves of standard British make; this will make possible critical discussion of possibilities of this method of amplification and determination of most suitable magnitudes of component elements.

Antenna-Mast Insulation. The Insulation of a Guyed Mast, H. P. Miller, Jr. Inst. Radio Engrs.—Proc., vol. 15, no. 3, Mar. 1927, pp. 225-243, 14 figs. Final decision as to value of mast and guy insulation will depend upon economic study of costs; change in effective height caused by using particular insulation arrangement can be measured on model such as that described and used to determine saving in power effected; balancing this saving against cost of insulators will show value of insulation.

Loud Speakers. Loud-Speaker Diaphragms, N. W. McLachlan. Wireless World, vol. 20, no. 12, Mar. 23, 1927, pp. 345-350, 12 figs. Influence of diameter of diaphragm on interference effects at high frequencies.

Tuning Condensers. The Resultant Capacity of Aerial Systems Employing Series Tuning Condensers, W. H. F. Griffiths. Experimental Wireless, vol. 4, no. 43, Apr. 1927, pp. 206-212, 9 figs. It is seen that if series aerial tuning condenser is designed treating aerial capacity merely as fixed value condenser in series, its design law will, in general, be approximately correct for all values of loading inductance greater than twice inductance of aerial and very closely correct when used in conjunction with loading coils of over ten times aerial inductance.

RAILS

Flaw Detection. Detecting Hidden Flaws in Rails. Iron Age, vol. 119, no. 15, Apr. 14, 1927, p. 1059. Magnetizing device, developed in Japan, claimed capable of locating flaws, fissures, segregation and other defects in rolled sections.

Joints, Welded. Progress Report Number Four Repeated Impact Tests. Committee on Welded Rail Joints, Am. Bur. Welding, Am. Elec. Ry. Eng. Assn., July 1926, 35 pp., 20 figs.

RAILWAY SIGNALLING

Coloured-Light Signals. C. & O. Completes Three-Track. Colour-Light, Either-Direction Signalling, B. T. Anderson. Ry. Signalling, vol. 20, no. 4, Apr. 1927, pp. 133-138, 12 figs. Also Ry. Age, vol. 82, no. 16, Mar. 19, 1927, pp. 950-953, 7 figs. Simplified scheme of indications with traffic locking and five new interlockers eliminates written train orders, increasing safety and speed of operation.

Chicago South Shore & South Bend Changes Signal Equipment, B. L. Smith. Ry. Signalling, vol. 20, no. 4, Apr. 1927, pp. 130-132, 8 figs. Union model-R colour-light signals replace upper-quadrant semaphores; high-speed spring switches installed at passing tracks.

Lever-Operated Switch. Lever-Operated Switch for Use with Can Signalling Ramps on Single Lines. Int. Ry. Congress—Bul., vol. 9, no. 3, Mar. 1927, pp. 267-269, 2 figs. French government requires principal railway companies to fit locomotives with cab signals for repeating all signals and semaphores; cab signal uniformly adopted is operated by metal brush carried on engines, when passing signal, making contact with fixed insulating conductor in form of ramp in middle of track. Translated from French.

RAILWAYS

Engineering Practice. Features of Railway Engineering Practice and Economics. Eng. News-Rec., vol. 98, no. 13, Mar. 31, 1927, pp. 536-537, 3 figs. Extracts from Committee Reports at Convention of American Railway Engineering Association, giving reviews of new developments and investigations in progress.

RAYON

Industry. Artificial Silk. Times Trade & Eng. Supp. (Artificial Silk Number), vol. 20, no. 456, Apr. 2, 1927, pp. 1-32, 74 figs. This special number contains following contributions: Outlook, S. Courtauld; Review of Industry in Canada, Germany, Spain, Holland, France, Italy, United States, Belgium, Japan, Switzerland, Czechoslovakia, etc.; Developments in Manufacture, W. P. Dreaper; Stable Fibres, E. Midgley; Acetate Silk, A. J. Hall; Artificial Hair, D. Hunter; Dress Fabrics, H. Jackson; Pulp Supplies, G. W. Andrews; Dyestuffs, R. S. Horsfall; German Machinery Industry, H. Jentgen; Yarn Characteristics; World's Markets; complete table of British exports in 1925 and 1926, etc.

REFRIGERATING MACHINES

CO_2 Compressors. Some Problems in the Application of Direct Connected Synchronous Motors to Carbon Dioxide Compressors, D. W. McLenegan. Refrig. Eng., vol. 13, no. 7, Jan. 1927, pp. 220-229, 14 figs. Torque and flywheel requirements.

REFRIGERATION

Carbon-Dioxide. Pointers on Carbonic Refrigeration, H. J. Macintire. Power Plant Eng., vol. 31, no. 7, Apr. 1, 1927, pp. 422-423. Discussion of questions that arise to perplex new user of CO_2 refrigeration.

Gas. Operating Cost of Household Refrigeration by Gas, W. R. Hainsworth. Refrig. Eng., vol. 13, no. 8, Feb. 1927, pp. 245-247, 1 fig. and (discussion) 247-248 and 252, 1 fig. Cost of energy alone has been considered; further advantage in operating cost of gas refrigeration system exists in possibilities of less service requirements and longer life.

RELAYS

A.C. Network. A.C. Network Relay Characteristics, D. K. Blake. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 4, Apr. 1927, pp. 361-369, 13 figs. Discusses required characteristics of relays for use with low-voltage automatic-network circuit-breaker; relay performs two functions of tripping and reclosing circuit-breaker; characteristic required for each function is discussed.

Time-Delay. Direct-Current Time-Delay Relays, J. V. Breisky. Elec. Jl., vol. 24, no. 4, Apr. 1927, pp. 179-183, 9 figs. New line of d.c. time-element relays, both polarized and non-polarized, of design which lends itself to universal application; they are of moving-vane type and use principle of magnetic damping; they are simple, rugged, accurate, and have desirable time-delay features.

RESERVOIRS

Storage. Storage Reservoir Relieves Overloaded Filters, P. J. Hurtgen. Water Works Eng., vol. 80, no. 6, Mar. 16, 1927, pp. 339-340, 3 figs. New reinforced-concrete covered unit overcomes tendency to overcrowd filters; allows of uniform filtration rate at all times.

ROADS

Foundations. A Survey of the Paving Situation, J. H. Neeson. Engrs. & Eng., vol. 44, no. 3, Mar. 1927, pp. 76-81. Résumé of situation as it effects Philadelphia in order to give conception of balance between paving with and without support of permanent foundation.

Foundation Strengthening. Methods of Strengthening Paving Foundations, F. W. Lyons. Engrs. & Eng., vol. 44, no. 3, Mar. 1927, pp. 73-74 and (discussion) 74-76. Deals with preparation of foundation, study of traffic which may logically be anticipated, section of base and obtainment of maximum resistance to prospective loading and financing of abnormal expenditures for street improvement.

ROADS, CONCRETE

Construction. Practical Considerations in Reinforced Concrete Construction, J. H. Southern. Surveyor, vol. 71, no. 1833, Mar. 11, 1927, p. 292. Results of tests carried out by author illustrating importance of correct placing of steel and of provision for adequate length of steel to be imbedded to prevent failure due to slip.

ROAD CONSTRUCTION

Ottawa. Work on the Ottawa Suburban Roads, A. K. Hay. Contract Rec., vol. 41, no. 12, Mar. 23, 1927, pp. 282-284, 4 figs. Construction and maintenance operations during 1926 on 76-mile system of highways; experimental use of cold-mix surface; detailed costs of base course, bituminous top and surface treatment work.

ROCK CRUSHING

Phenomena. Rock Grinding Phenomena, A. M. Gaudin. Pit & Quarry, vol. 13, no. 13, Mar. 30, 1927, pp. 67-72, 29 figs. Results of experiments conducted at laboratories on mechanical preparation of minerals; presents laws formulated as result of these experiments. Translated from Revue de Métallurgie.

ROADS, GRAVEL

Maintenance. The Maintenance of Gravel Roads, J. T. Sharpensteen. Roads & Streets, vol. 67, no. 3, Mar. 1927, pp. 134-135. Methods and equipment used in certain sections of Michigan. Paper presented before Highway Eng. Conference, Univ. of Michigan.

ROLLING MILLS

Electric Drive. 1926 Developments in Electric Drive, A. F. Kenyon. Iron Age, vol. 119, no. 15, Apr. 14, 1927, pp. 1068-1071, 5 figs. Rolling-mill equipment underwent notable advances in control; large units multiplying rapidly.

Layout and Equipment. Rolls Wide Range of Products, R. A. Fiske. Iron Age, vol. 119, no. 13, Mar. 31. 1927, pp. 923-926, 6 figs. Mill at Wisconsin Steel Works is equipped to produce universal plates, structural shapes, rounds, squares and flats. See also description in Iron Trade Rev., vol. 80, no. 13, Mar. 31, 1927, pp. 832-834, 4 figs.

ROOFING

Felts. Determination of the Fibre Composition of Roofing Felts, R. E. Lofton. Paper Trade Jl., vol. 84, no. 14, Apr. 1927, pp. 57-58. Dot-count method of observation.

S

SAND, MOULDING

Reclamation. Restore Moulding Sand Bond, W. F. Prince. Foundry, vol. 55, no. 6, Mar. 15, 1927, pp. 236-237. Recounts early experiences in attempting to reclaim foundry sand and states that many modern claims cannot be sustained.

SAWS

Cold. A New Cold Saw, U. Lohse. Eng. Progress, vol. 8, no. 3, Mar. 1927, pp. 77-78, 6 figs. Details of Mars metal saw for removing gates, risers and dead heads of large section from iron and steel castings.

Hack-Saw Blades. Standardizing Hack-Saw Blades, R. Job. Ry. Mech. Engr., vol. 101, no. 3, Mar. 1927, pp. 169-171. Specifications based on simple shop test leave chemical composition and heat treatment to discretion of manufacturer.

SEMI-STEEL

Properties. Semi-Steel, J. E. Hurst. Foundry Trade Jl., vol. 35, nos. 552 and 553, Mar. 17 and 24, 1927, pp. 231-232 and 257-258. Mar. 17: Composition; total carbon contents. Mar. 24: Industrial semi-steel; low total carbon semi-steels; character of steel additions; soundness and regularity of final castings.

SEWAGE DISPOSAL

Activated Sludge. Operation of Activated Sludge Plants. Surveyor, vol. 71, no. 1834, Mar. 18, 1927, pp. 309-314. Sewage works managers' discussion at Wakefield; aeration capacity; question of management; difference in sewages; means of readily increasing aeration; Sheffield method of agitation; design of aeration tanks; satisfactory effluent; continuous fill and draw method.

Imhoff Tanks. Chlorination Reduces Foaming in Imhoff Tanks, C. Cohen. Eng. News-Rec., vol. 98, no. 14, Apr. 7, 1927, pp. 563-564. Working scale trials at Lufkin, Tex., indicate that prechlorination with 3 p.p.m. will control foaming.

SEWERS

Soft Ground Tunnelling. Soft Ground Tunnelling Methods for Small Sewer. Eng. News-Rec., vol. 98, no. 12, Mar. 24, 1927, pp. 478-479, 2 figs. Two methods of tunnelling compared; clay and wet gravel penetrated; cant and shield method found superior.

SEWAGE DISPOSAL

Plants. Sewage Disposal Plant at St. Thomas (Ont.), W. C. Miller. Can. Engr., vol. 52, no. 11, Mar. 15, 1927, pp. 345-348, 5 figs. Considerations favouring adoption of activated sludge process; aeration tanks have daily capacity of 2,000,000 gallons of raw sewage; aeration and sedimentation tanks in two units operating in parallel; old tanks used in construction of new plant.

SHAFTS

Whirling Speed. Application of an Integral Equation to the Whirling Speeds of Shafts, R. C. J. Howland. Lond., Edinburgh and Dublin Philosophical Mag. & Jl. of Sci., vol. 3, no. 15, Mar. 1927, pp. 513-528. Squares of whirling speeds of shaft are exhibited as characteristic numbers of homogeneous integral equation; approximate solutions are sought by applying approximation formulas to integral and whirling speeds are found as roots of determinantal equation.

SHAPERS

Railway. Haavy-Duty Railroad Shaper of Improved Design. Iron Age, vol. 119, no. 14, Apr. 7, 1927, pp. 1003-1004, 3 figs. Attachments provided for machining driving boxes, shoes and wedges, rod brasses and other work on production basis.

SNOW REMOVAL

Montreal. Snow Removal Problem in Montreal, C. J. LeBlanc. Can. Engr., vol. 52, no. 11, Mar. 15, 1927, pp. 355-356, 3 figs. Large expenditure for snow removal due to heavy precipitation; costs nearly $1,500,000 per year; classifications to facilitate accounting methods employed in clearing snow from car tracks, streets and sidewalks.

SPEED REDUCERS

Types and Applications. Speed-Reducer Types and Their Application to Industrial Requirements. West. Machy. World, vol. 18, no. 3, Mar. 1927, pp. 112-115 and 137, 15 figs. Deals with different types of speed reducers most suitable and economical for various kinds of industrial service; common types are grouped into three classes; spur-gear, herringbone-gear and worm-gear speed reducers.

SPRINGS

TEMPERING AND RESETTING. Tempering and Resetting Springs, C. A. Kyle. Elec. Ry. Jl., vol. 69, no. 13, Mar. 26, 1927, pp. 576-577, 1 fig. Spring repairs are facilitated and cost of tempering and resetting springs reduced by spring-tempering furnace of gas-burning type installed in shops of New York State Railways, Syracuse, N.Y.

TESTING AND SCRAGGING MACHINES. Spring Testing and Scragging Machines. Machy. (Lond.), vols. 28 and 29, nos. 727, 728, 729 and 737, Sept. 16, 23, 30 and Nov. 25, 1926, pp. 724-725, 754-756, 789-790 and 250-251, 18 figs. Describes various types of spring-testing machines.

STEAM POWER PLANTS

DESIGN. Tendencies in Power Plant Design, F. Hodkinson. West. Soc. Engrs.—Jl., vol. 32, no. 1, Jan. 1927, pp. 10-28, 7 figs. Progress made in utilizing heat energy; increase in station efficiency; power production combined with other features; power as by-product of process heating; high steam pressures; gains due to reheating; selection of auxiliaries; floating house turbine as standby; dissolved oxygen removed from feedwater; relation of size and speed; desirability of standardization.

DESUPERHEATERS. Steam Desuperheaters. Nat. Engr., vol. 31, no. 4, Apr. 1927, p. 156, 3 figs. Several types of coolers or desuperheaters have been developed to cool heating steam to desired temperature; describes three types, with special reference to very compact type no larger than ordinary valve in which heat transmission is so effective that up to 10 per cent addition of water in spherical filter is totally evaporated to height of 200 mm. Translated abstract from VDI Zeit., Apr. 18, 1925.

INDUSTRIAL. Industrial Power-Plant Development, S. G. Neiler. Power, vol. 65, no. 14, Apr. 5, 1927, pp. 510-512, 4 figs. Requirements in various manufacturing departments of industry must be considered and demands for service correlated, if maximum results are to be obtained; economical production of power, utilization of by-products, use of higher-speed machines, improved methods of handling and factory routing are some of problems involved.

MINE-MOUTH. Mine-Mouth Power Plants Have Limitations, G. A. Orrok. Power Plant Eng., vol. 31, no. 7, Apr. 1, 1927, pp. 425-426. Market, water supply and fuel reserve are principal factors affecting plant location. Address at Int. Conference on Bituminous Coal.

OIL-ELECTRIC. Unusual Power Demands in Rubber Industry. Oil Engine Power, vol. 5, no. 4, Apr. 1927, pp. 230-232, 5 figs. Describes rubber-mill oil-engine installation in plant of Bickett Rubber Products Corp.; Falk oil engine is 2-cylinder, 4-cycle type developing 300 b.h.p. at 257 r.p.m.

PURCHASING AND GENERATING POWER. How One Concern Solved the Problem of Power for a Small Plant, G. H. Kimball. Power, vol. 65, no. 16, Apr. 19, 1927, pp. 592-593. By purchasing all power in non-heating season and generating enough power during heating season, more than $10,000 a year was saved over previous practice of generating power all time; new arrangement also provided reserve capacity that insured essential continuity of electric service.

STEAM TRAPS

CALCULATION. Calculation of Dimensions for Expansion Traps of Water-Tube Boilers (Le calcul des dimensions à donner aux trappes d'expansion des générateurs aquatubulaires), M. Bochet. Associations Françaises de Propriétaires d'Appareils à Vapeur—Bul., no. 26, Oct. 1926, pp. 233-240, 1 fig. Presents theoretical study. See also comment on pp. 241-242, 1 fig.

STEAM TURBINES

BACK-PRESSURE. Small Back-Pressure Turbines. E. A. Kraft. AEG Progress, vol. 2, no. ½, Apr. 1926, pp. 30-31, 2 figs. Details of 300-kw. installation supplied to bleaching and dye works in Vienna; consists of back-pressure turbine, gearing and d.c. generator; turbine runs at speed of 7,000 r.p.m. and d.c. generator at 1,000 r.p.m.; other similar installations.

BLADES. New Method of Calculating Multiple Blades of Impulse Turbines (Une nouvelle méthode de calcul des ailettages multiples à action), C. Colombi. Technique Moderne, vol. 19, no. 4, Feb. 15, 1927, pp. 97-104, 3 figs. Multiple-action turbine is composed of series of elementary turbines; deals with rapid calculation of assembling of turbine from its different elements.

DESIGN. A New Method of Construction for Steam Turbines. Eng. Progress, vol. 8, no. 3, Mar. 1927, p. 70. 3 figs.

DEVELOPMENTS. Steam Turbine Development, E. Pragst. Iron & Steel Engr., vol. 4, no. 3, Mar. 1927, pp. 137-143, 15 figs. Deals only with impulse type as manufactured by General Electric Co.

PACKING GLANDS. Leakage Loss in Labyrinth Glands, J. Ward. Inst. of Mar. Engrs.—Trans., vol. 39, Mar. 1927, pp. 110-117, 4 figs.

STEEL

AUSTENITE DECOMPOSITION. The Decomposition of the Austenitic Structure in Steels, R. L. Dowdell and O. E. Harder. Am. Soc. Steel Treating—Trans., vol. 11, no. 4, Apr. 1927, pp. 583-606, 72 figs.

BALL-BEARING. Comparative Tests on Ball-Bearing Steels, T. L. Robinson. Am. Soc. Steel Treating—Trans., vol. 11, no. 4, Apr. 1927, pp. 607-618, 23 figs.

CHROMIUM-NICKEL. *See Chromium-Nickel Steel.*

CORROSION. Influence of Rust-Film Thickness Upon the Rate of Corrosion of Steels, E. L. Chappell. Indus. & Eng. Chem., vol. 19, no. 4, Apr. 1927, pp. 464-466, 1 fig.

DISTORTION IN. Distortion in Heat-Treated, Case-Hardened Carbon Steels, P. J. Haler. Junior Instn. Engrs., vol. 37, Feb. 1927, pp. 216-231, 8 figs. Case-hardening process; considerations relating to distortion; pressure caused by heat treatment; quenching; hardening of milling cutters; relative speed of cooling of skin and interior; applications of theory to practice. Bibliography.

HEAT-RESISTING STAINLESS. Progress in the Development and Practical Application of Heat-Resisting and Non-Corroding Steels, R. Hadfield. Inst. Mar. Engrs.—Trans., vol. 39, Feb. 1927, pp. 1-47 and (discussion) 47-53, 16 figs.

PHYSICAL COMPOSITION. The Physical Composition of Steel, J. D. Gat. Blast Furnace & Steel Plant, vol. 15, no. 4, Apr. 1927, pp. 173-176, 1 fig. Open-hearth and rolling-mill practice and their influence upon grain structure; effects of rate of cooling; types of ingot moulds employed.

SEMI-STEEL. *See Semi-Steel.*

SMOOTH-FINISH MACHINING. Smooth-Finish Machining of Low-Carbon Plain and Alloy Steels, J. S. Vanick and T. H. Wickenden. Am. Soc. Steel Treating—Trans., vol. 11, no. 4, Apr. 1927, pp. 551-568, 3 figs.

STAINLESS. The Machining of Stainless Steels. Machy. (Lond.), vol. 29, no. 754, Mar. 24, 1927, pp. 815-817. Turning and screwing stainless steel; stainless steel on turret lathes.

STEEL CASTINGS

SOUNDNESS. Section Affects Soundness of Steel. Forging—Stamping—Heat Treating, vol. 13, no. 3, Mar. 1927, pp. 101-102. Tests from forgings and castings show varying characteristics dependent upon location and section of pieces for tensile or chemical determinations.

STEEL, HEAT TREATMENT OF

OVERHEATING. Study of Overheating of Steels (Etude sur la surchauffe des aciers), L. Aisenstein. Revue Universelle des Mines, vol. 13, no. 3, Feb. 1, 1927, pp. 106-115, 10 figs. Conclusion of work published in same journal in 1925 (vol. 8, no. 6, Dec. 15, 1925); present study deals with nickel and chrome steels. See reference to 1st part in Eng. Index 1926, p. 713.

OXY-ACETYLENE FLAME. Heat Treatment with the Torch, E. E. Thum. Acetylene Jl., vol. 28, no. 10, Apr. 1927, pp. 473-476 and 478, 7 figs. Hardening of small tools; relationships between metal and flame; hardening; drawing or tempering; hardening of malleable iron; annealing.

STRESSES DUE TO QUENCHING AND TEMPERING. Stresses in Quenched and Tempered Steel, S. L. Hoyt. Am. Soc. Steel Treating—Trans., vol. 11, no. 4, Apr. 1927, pp. 509-527 and (discussion) 528-530 and 658.

STREAM FLOW

REGULATION. Storage Required for the Regulation of Stream Flow. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 4, Apr. 1927, pp. 624-638, 3 figs. Discussion of paper by C. E. Sudler, published in Dec. 1926, Proceedings. See reference to original article in Eng. Index 1926, p. 723.

SUBSTATIONS

AUTOMATIC CONTROL. Rapid Growth of Automatic Substation Control Due to Its Great Economic Advantages, E. G. Peterson. Coal Age, vol. 31, no. 13, Mar. 31, 1927, pp. 461-464, 5 figs. Power savings and attendance costs are reduced; protection to machines better than possible with human attendance; control of synchronous motors readily aids in correcting power factor.

BUNGALOW-TYPE. Substations for Residential Districts, H. L. Doolittle. Elec. World, vol. 89, no. 14, Apr. 2, 1927, pp. 697-699, 5 figs. Necessity for locating substations in high-class residence districts leads to development of bungalow-type substation of pleasing Spanish architecture.

OUTDOOR. Steel-Cell Unit-Type Outdoor Substation, R. C. Powell. Elec. World, vol. 89, no. 9, Feb. 26, 1927, pp. 449-450, 5 figs. Lower cost, higher salvage value, better appearance and possibility of using equipment obtained from rebuilding of large indoor stations constitute important advantages of this type of outdoor construction.

SURVEYING

TOPOGRAPHICAL AND EXPLORATION. Topographical and Exploration Surveys, T. H. Bartley. Can. Engr., vol. 52, no. 14, Apr. 5, 1927, pp. 407-410 and 414, 5 figs. Progress in topographical surveying in Canada; Dominion Government aerial surveys; Ontario Government land surveys and geological field work. Committee report presented at meeting of Ontario Land Surveyors.

T

TESTING MACHINES

HYDRAULIC. Hydraulic Testing Machine. Iron Age, vol. 119, no. 15, Apr. 14, 1927, p. 1077, 1 fig. New machine of 1,000,000-lb. capacity, intended for use in testing of side frames and bolsters of freight car trucks.

TEXTILE MILLS

MECHANICAL RESEARCH. Mechanical Improvement in Manufacturing, H. S. Busby. Textile World, vol. 71, no. 12, Mar. 19, 1927, pp. 25-26. Stabilization of production and earning capacity by improvement of internal conditions; opportunities available from increasing range of equipment and making better use of working schedules; method and organization for mechanical research; bearing on management problem.

METAL-WORKING MACHINES IN. Old Equipment Prevents Profit in Textile Machinery. Am. Mach., vol. 66, no. 12, Mar. 24, 1927, pp. 479-480, 2 figs. Data compiled from replies to questionnaire showing that of total of approximately 32,000 machines, nearly 18,000 have passed ten-year point.

THERMIT WELDING

LARGE PIECES. Thermit Welding, J. H. Deppeler. Tech. Eng. News, vol. 8, no. 2, Mar. 1927, pp. 59 and 100, 2 figs. Welding of large pieces by this method.

TIRES, RUBBER

MOTOR TRUCK. The Motor Truck Tire in Its Relations to the Vehicle and to the Road, J. A. Buchanan. Soc. Automotive Engrs.—Jl., vol. 20, no. 4, Apr. 1927, pp. 469-477, 14 figs. Presents some important data that have resulted from researches by Bur. Public Roads; general view is given of effects of vehicle type, wheel load, tire equipment, speed and road conditions on gasoline consumption, tractive resistance and impact reactions.

TRAFFIC

CONTROL. Traffic Regulation, E. J. McIlraith. Pub. Service Mgmt., vol. 42, no. 4, Apr. 1927, pp. 105-108, 3 figs. Points out that only regulation which is adequate is that which seeks to solve problems of community as a whole and not of any one section; deals with Chicago problems.

TRANSFORMERS

DESIGN. Design of Reactances and Transformers Which Carry Direct Current, C. R. Hanna. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 2, Feb. 1927, pp. 128-131, 8 figs. It is usually necessary to place an air gap in core of reactance or transformer which carries direct current in order to secure greatest inductance; direct method of designing such reactances or transformers, including determination of best value of air gap.

INSULATION. Core-Type Transformers for High Pressures: Design of Major Insulation, W. B. Garrett. World Power, vol. 7, no. 40, Apr. 1927, pp. 192-196, 6 figs. Deals with methods of deciding arrangement of insulating mediums having regard only to their dielectric properties.

OIL FILTERS. Experience with New Insulating Oil Filter, R. E. Dennis. Elec. World, vol. 89, no. 13, Mar. 26, 1927, pp. 647-649, 5 figs. New method for clarifying and dehydration of transformer and switch oil; utility requirements of ideal filter enumerated; data on performance under operating conditions included.

TRANSPORTATION

ECONOMIES. Transportation Economies and Current Problems, S. O. Dunn. Ry. Age, vol. 82, no. 17, Mar. 26, 1927, pp. 979-982. Railways and other carriers; "fair return" theory likely to increase rather than reduce cost of service to public.

TUBES

STEEL, SEAMLESS. Seamless Steel Tubing; A Bibliography, V. S. Polansky. Blast Furnace & Steel Plant, vol. 15, nos. 2, 3 and 4, Feb., Mar. and Apr. 1927, pp. 88-91, 133-136 and 180-182 and 192. Practically all phases of tube manufacture are covered; Pilger and Mannesmann process receive special attention; American and foreign practice.

V

VANADIUM

RECOVERY FROM IRON ORES. Recovering the Vanadium in Titaniferous Iron Ores, B. P. F. Kjellberg. Eng. & Min. Jl., vol. 123, no. 13, Mar. 26, 1927, pp. 521-522. Process embodying roasting and leaching concentrates.

VENTILATION

SCHOOLS. Panel System Adopted in Solution of School Ventilation Problem. Heat. & Vent. Mag., vol. 24, no. 4, Apr. 1927, pp. 85-86, 3 figs. Scheme proposed involves use of radiant heat emitted from flat plates.

VENTURI METERS

TUBE CHARACTERISTICS. Venturi Tube Characteristics. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 4, Apr. 1927, pp. 610-623, 10 figs. Discussion of paper by J. W. Ledoux published in Nov. 1926, Proceedings.

Venturi Tube Characteristics. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 4, Apr. 1927, pp. 610-623, 12 figs. Discussion of paper by J. W. Ledoux, published in Nov. 1926, Proceedings. See reference to original article in Eng. Index 1926, p. 778.

VOLTAGES

STANDARDIZATION. Standardization of Voltage Ratings for Power Systems and Equipment, A. E. Silver and A. L. Harding. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 3, Mar. 1927, pp. 242-251, 1 fig. Analyzes voltage practices and requirements of a.c. power systems with aim of arriving at voltage standards that adequately correct and extend present standards; for this analysis and development of voltage standards comprehensive chart showing operating voltage limits of representative systems is given; tabulation summarizing proposed standard voltage ratings.

STANDARDS. Voltage Standards for Electrical Distribution, H. B. Gear. Am. Inst. Elec. Engrs.—Jl., vol. 46. no. 4, Apr. 1927, pp. 344-345. Discusses necessity for standardizing voltages and advocates utilization voltage as most logical reference base; suggests that ratios adopted should be uniform at all voltages; proposes that there should be recognized standard for transformers in which direction of energy flow is subjected to change.

W

WASTE ELIMINATION

SMALL PLANTS. Applying Scientific Knowledge to the Small Plant, D. S. Cole. Indus. Mgmt. (N.Y.), vol. 73, no. 3, Mar. 1927, pp. 155-160. Discussion of possibilities of research tending to eliminate waste.

WATER SOFTENING

ZEOLITE. Recent Developments in Zeolite Softening, A. S. Behrman. Indus. & Eng. Chem., vol. 19, no. 4, Apr. 1927, pp. 445-447, 3 figs.

WATER SUPPLY

QUEBEC. The Water Supplies of Quebec Province. T. J. Lafreniere. Can. Engr., vol. 52, no. 10, Mar. 8, 1927, pp. 97 and 100-101. Points out that filtration and chlorination are not reducing rate to extent that could be accomplished. Address delivered before Can. Section, Am. Water Works Assn.

RATE-MAKING. Determination of Equitable Water Rates, J. C. Keith. Can. Engr., vol. 52, no. 10, Mar. 8, 1927, pp. 110-113, 1 fig. Problems involved in fixing assessments and regulating charges for water service in municipalities. Paper presented before Can. Section, Am. Water Works Assn.

WASTE DETECTION. Detecting Water Waste by Surveys, A. D. Stalker. Can. Engr., vol. 52, no. 10, Mar. 8, 1927, pp. 102 and 149-150, 1 fig. Various ways in which water is wasted; locating leaks in underground distribution systems by means of Pitometer survey. Paper read before Can. Section, Am. Water Works Assn.

WATERPROOFING

MATERIALS FOR. United States Government Master Specifications for Integral Waterproofing Material, Water-Repellent Type (For Use with Portland Cement Mortar or Concrete). U.S. Bur. Standards—Cir., no. 322, specification no. 444, Feb. 1, 1927, 4 pp. General specifications; types; materials and workmanship; detail requirements; inspection, sampling and tests; packing and marking.

WATER TREATMENT

CHLORINATION. Résumé of Progress in Chlorination, N. J. Howard, Can. Engr., vol. 52, no. 10, Mar. 8, 1927, pp. 116-118. New theories as to germicidal action; economy of prechlorination method; value of chloramine and superchlorination in taste prevention. Paper read before Can. Section, Am. Water Works Assn.

Super-Chlorination of Chlorophenol Tastes, L. B. Harrison. Am. Water Works Assn.—Jl., vol. 17, no. 3, Mar. 1927, pp. 336-340. Cities in many states throughout Union have been suffering from chlorophenol tastes; through many experiments it has been definitely demonstrated that these tastes are caused by combination of chlorine and phenolic wastes; results of author's experiments to find out possibility of using superchlorination as means of destroying these tastes; it is questionable in his mind whether it will work out on large scale in practice, where temperature complications may present themselves; he believes research should be bent upon finding some substitute for chlorine to be applied during periods when superchlorination fails.

COAGULANTS. The Use of Sodium Aluminate as a Coagulant for Water Purification, J. B. Barnitt and E. H. Haux. Modern Irrigation, vol. 3, no. 3, Mar. 1927, pp. 38-41. Difficulties encountered in using filter alum somewhat lessened by sodium aluminate properly introduced into filtration process.

PRACTICE. Trend of Practice in Water Purification, P. Hansen. Can. Engr., vol. 52, no. 10, Mar. 8, 1927, pp. 95-97. Discusses limits in placing further loads on filtration plants, and probable necessity of giving more attention to sewage disposal. Address before Can. Section, Am. Water Works Assn.

WATER WORKS

OTTAWA, ONT. Ottawa Municipal Water Works System, W. E. MacDonald. Can. Engr., vol. 52, no. 10, Mar. 8, 1927, pp. 103-106, 6 figs. Describes growth of system, pumping plants, pipe lines, distribution system, metering and service to customers. Paper read before Can. Section, Am. Water Works Assn.

WATT-HOUR METERS

INDUCTION. Theory of Action of the Induction Watt-Hour, D. T. Canfield. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 4, Apr. 1927, pp. 328-336, 13 figs. Discusses development of temperature-compensated watt-hour meter; effect of certain changes in fundamental constants of meter circuits and materials of certain vital parts are shown to indicate necessity of two independent compensating devices; meter and analysis of its temperature errors.

WEIGHTS AND MEASURES

DERIVATION OF MEASURES. The Geometric and Geographical Derivation of Measures. Surveyor (Sydney), vol. 36, no. 3, Oct. 1926, pp. 112-119. Shows distinction which it is always necessary to observe in investigation of measures between geometric and geographical values; it seems evident that ancient cubit system was geometric, but was about 100 B.C. confused by introduction of geographical stadion system, and is now being complicated by metric system; only permanent conception of datum in respect to measures is universally accepted datum of mathematics, unit of radius, that is, radius equals one.

WELDING

CENTRAL STATIONS. Welding Reduces Power House Costs, T. E. dePew. Welding Engr., vol. 12, no. 3, Mar. 1927, pp. 25-27, 8 figs. Lower building, operating and maintenance charges are insured by its use at N.Y. Edison East river station.

ELECTRIC. *See Electric Welding, Arc.*

OXY-ACETYLENE. *See Oxy-Acetylene Welding.*

PIPE. Pipe Welding Under Difficulties, G. Walker. Welding Engr., vol. 12, no. 3, Mar. 1927, pp. 29-30, 9 figs. Describes high-pressure steam pipe line which was welded under extremely severe winter weather conditions; welded joint chosen as best for high-pressure line; pipes connected outdoors in mid-winter; line tests free of leaks.

STEEL CASTINGS. The Selection of a Welding Process, L. E. Everett. Forging—Stamping—Heat Treating, vol. 13, no. 3, Mar. 1927, pp. 98-100. Reasons for welding steel castings are considered; its use is not extensive, but for small defects is justified.

STELLITING. Stelliting: A New Welding Process, A. V. Harris. West. Machy. World, vol. 18, no. 3, Mar. 1927, pp. 104-105 and 137, 6 figs. Method of surfacing metal parts with stellite which effects important savings wherever utilization of remarkable properties of alloy is productive of economy.

STEEL PLATE. Different Methods of Welding Steel Plates (Les différentes méthodes d'exécution des soudures sur toles d'acier). Revue de la Soudure Autogène, vol. 19, no. 156, Feb. 1927, pp. 1301-1307, 28 figs. Describes different methods and gives examples of their application.

THERMIT. *See Thermit Welding.*

WOOD

FINISHING. Wood Lacquer Finishes. Mech. Eng., vol. 49, no. 4, Apr. 1927, pp. 329-331. Review of four papers presented at Wood Industries Session; measuring depth of varnished surface; effects of flues and fillers on lacquer; use of Cooper Hewitt lamp in evaluating lacquers.

Z

ZINC

ELECTROLYTIC. Twenty-Five Years' Progress of Electrolytic Zinc, O. C. Ralson. Am. Electrochem. Soc.—Advance Papers, Apr. 28-30, 1927, no. 22, 6 pp. To-day, due largely to work of last 15 years, world's electrolytic zinc output is 19 per cent of total zinc output; elaborate plans are under way for further expansion; first successful electrolyte was chloride, although to-da most plants are using acid-sulphate electrolyte; among valuable by-products that are recoverable are cadmium, vanadium and manganese.

Engineering Index

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A

AIR COMPRESSORS

Air-Delivery Measurement. Measurement of Air Delivery from Compressors, J. N. Williamson. Colliery Eng., vol. 4, no. 38, Apr. 1927, pp. 137-140 and 164, 4 figs. Measurement of volume by receiver method; delivery efficiency; precautions necessary; measurement by nozzle method; low-pressure method; high-pressure nozzle method; determination of size of nozzle.

Centrifugal. Centrifugal Compressors (Les compresseurs centrifuge), L. Lahousay. Revue de l'Industrie Minérale, no. 152, April 15, 1927, pp. 155-176, 28 figs. General principles of compression in centrifugal apparatus; number of stages; principles of refrigeration, and different processes employed in cooling of air; output of centrifugal compressors and energy losses; characteristic curves; control and utilization of compressors in compressed-air plants.

AIR CONDITIONING

Industrial Buildings. Getting Away from the Handicap of Climate, F. R. Ellis. Indus. Mgmt. (N.Y.), vol. 73, no. 5, May 1927, pp. 274-278. Air conditioning in industrial buildings; saturation and air temperature; effect of humidity on materials and process; production of artificial climate; removing excess moisture from air; control of air-conditioning equipment; applications of air conditioning in textile industry and other industries.

AIRPLANE ENGINES

Fuel-Injection. Some Factors Affecting the Reproducibility of Penetration and the Cut-Off of Oil Sprays for Fuel-Injection Engines, E. G. Beardsley. Nat. Advisory Committee for Aeronautics—Report, no. 258, 1927, 10 pp., 6 figs. Investigation was undertaken by Langley Memorial Aeronautical Laboratory to determine factors controlling reproducibility of spray penetration and secondary discharges after cut-off; effects of two types of injection valves, injection-valve tube length, initial pressure in injection-valve tube, speed of injection control mechanism, and time of spray cut-off, on reproducibility of spray penetration, and on secondary discharges.

Power Measurement in Flight. The Direct Measurement of Engine Power on an Airplane in Flight with a Hub Type Dynamometer, W. D. Gove and M. W. Green. Nat. Advisory Committee for Aeronautics—Report, no. 252, pp. 3-11, 11 figs. Tests made at Langley Memorial Aeronautical Laboratory to obtain direct measurements of engine power in flight; tests were made with Bendemann hub dynamometer installed on modified DH-4 airplane, Liberty 12 engine, to determine the suitability of this apparatus.

AIRPLANE PROPELLERS

Characteristics. Airscrew Characteristics and Aeroplane Performance Prediction, J. D. Blyth. Instn. Aeronautical Engrs.—Jl., vol. 1, no. 4, Apr. 1927, pp. 30-37. Presents in immediately useful form information contained in certain publications; method of performance prediction involves use of air screw-torque function curve.

AIRPLANES

Airfoils. Tests of Pneumatic Means for Raising Airfoil Lift and Critical Angle, E. N. Fales and L. V. Kerber. Soc. Automotive Engrs.—Jl., vol. 20, no. 5, May 1927, pp. 575-581, 8 figs. Wind-tunnel research directed toward discovery of satisfactory high-lift wing that would have advantage of structural simplicity, high wing loading, low landing speed, and, if possible, reasonably low drag.

Design. Apparent Present Tendencies in Airplane Design, V. E. Clark. Aviation, vol. 22, no. 19, May 9, 1927, pp. 985-988, 3 figs. Review of recent developments and practice in various countries, pointing out successful results obtained with designs of widely different types.

Some Notes on the Possibilities of Progress in Aviation. Instn. Aeronautical Engrs.—Jl., vol. 1, no. 4, Apr. 1927, pp. 5-25 and (discussion) 25-29, 20 figs. Theory of boundary layer; compares flow around streamline strut and cylinder; means by which lift is increased and drag reduced; concludes that even small disturbances should be avoided, especially on suction side of wings; slotted wings and rotors show how departure may be prevented; new method of sucking air into body may be applied in several ways.

Standardization. Standardization in the Air, J. F. Hardecker. Automotive Industries, vol. 56, no. 15, Apr. 16, 1927, pp. 575-577. Rapid progress is made by aircraft industry in standard work since chaotic days of 1918; S. A. E. largely instrumental in starting movement.

AIRSHIPS

Design. Modern Air-Ships, H. C. A. Von Parseval. Eng. Progress, vol. 8, no. 4, Apr. 1927, pp. 109-111, 1 fig. Commercial airships must use hydrogen for inflation; for peaceful purposes, taut, purely inflated airships are more suitable than such with skeletons as they are cheaper, have greater load capacity and do not involve risk of fractures in skeleton; taut, inflated airships have been much improved by introducing steel netting.

ALLOYS

Aluminum. *See Aluminum Alloys.*

Elasticity and Viscosity. Elastic and Viscous Properties of Alloys (Les propriétés élastiques et visqueuses des alliages), M. Chevenard. Société des Ingénieurs Civils de France—Procès-Verbal, no. 6, Apr. 8, 1927, pp. 134-140 and (discussion) 140-142. Modula of elasticity and internal friction; influence of temperature, composition, cold working and hardening; isothermal viscosity; viscosity at increasing temperature.

Non-Ferrous. *See Non-Ferrous Alloys.*

ALLOY STEELS

Molybdenum in. Molybdenum in Alloy Steels. Metallurgist (Supp. to Engineer), Apr. 20, 1927, pp. 51-52. Review of report by J. A. Jones, of Research Department, Woolwich, on influence of molybdenum on medium-carbon steels containing nickel chromium, dealing with wide ranges of steels to which molybdenum has been added; report confirms Gillett and Mack's work in establishing definite field of utility for molybdenum as additional constituent of alloy steels; outstanding feature among properties of nickel-chromium-molybdenum steels is relative absence of mass effect shown by uniformity of properties through thickness of large forgings after treatment.

Railways. Alloy Steels in the Railroads, F. J. Griffiths. Ry. Club of Pittsburgh—Official Proc., vol. 26, no. 5, Mar. 24, 1927, pp. 94-98 and (discussion) 98-116. Use of high-manganese rails; vanadium steel in locomotive frames, side arms, rods and pins; leaf springs which were formerly made of carbon steel are now made of silico-manganese or of chrome vanadium; alloy-steel bearings for railroad cars; heat-treated alloy steels in staybolts and engine bolts; alloys used for sake of resistance to corrosion.

ALUMINUM ALLOYS

Aircraft Industry. U.S. Aircraft Industry Developing Into Important Factor in Aluminum and Light Alloys. Am. Metal Market, vol. 34, no. 75, Apr. 19, 1927, pp. 3-5, 7 figs. Presents replies to questionnaire sent out to producers of aircraft, showing extent and nature of aluminum consumption at present time; there is belief in engineering circles that all-metal type will be generally adopted, owing to numerous advantages gained in operation by reason of strong and light qualities of duralumin.

Calcium, Influence of. The Influence of Calcium on Aluminum Containing Silicon, J. D. Grogan. Metal Industry (Lond.), vol. 30, no. 15, Apr. 15, 1927, pp. 383-385, 4 figs. Results of investigations; on addition of calcium to aluminium compound $CaAl_2$ appears completely soluble in molten aluminium within range examined, but very slightly soluble in solid aluminium; on addition of silicon to this alloy compound $CaSi_2$ is formed, completely soluble in molten aluminium; in solid aluminium solubility is extremely small at all temperatures. Abstract of paper read before Inst. of Metals.

AMMONIA COMPRESSORS

Clearance Pockets. Clearance Pockets for Ammonia Compressors, W. H. Motz. Power Plant Eng., vol. 31, no. 10, May 15, 1927, pp. 577-579, 3 figs. Recent developments in clearance pockets; amount of clearance necessary for zero capacity; construction and operation.

ANTIMONY

Deposits, Properties and Uses. Antimony, W. V. Smitheringale. Can. Min. Met.—Bul., no. 180, Apr. 1927, pp. 414-468. Outline of geology of world's antimony deposits and a proposed classification; with notes on properties and uses of antimony and its compounds.

AQUEDUCTS

Flow Tests. Flow Tests of Winnipeg Water District Aqueduct, F. S. Adamson and J. H. Grant. Eng. News-Rec., vol. 98, no. 17, Apr. 28, 1927, pp. 693-694, 4 figs. Salt-velocity method proves quick and accurate and checks with current-meter tests after six years' use.

ARCHES

Multiple. The Design of a Multiple-Arch System and Permissible Simplifications. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 924-957. Discussion of paper by A. C. Janni, published in same journal in 1925.

ARTILLERY

Anti-Aircraft. Anti-Aircraft Progress, 1926, G. M. Barnes. Ord. Dept., U.S.A. Army Ordnance, vol. 7, no. 41, pp. 339-346, Mar.-Apr., 13 figs. Results of tests at Aberdeen; machine-gun tests; 37-mm. gun tests; fire control for 3-in. anti-aircraft battery, transmission system; 3-in. gun with torque amplifier; 105-mm. gun and carriage.

AUTOMOBILE ENGINES

Air Cooling. Air Cooling, J. F. Alcock. Automobile Engr., vol. 17, no. 227, Apr. 1927, pp. 130-134, 14 figs. Experimental method evolved by author of evaluating cooling effect of air streams.

Developments. Some Notes on Petrol-Engine Development, H. R. Ricardo. Automobile Engr., vol. 17 no. 227, Apr. 1927, pp. 149-152 and (discussion) 153-154, 9 figs. How to suppress detonation; valve position; supercharging; torque recoil.

Oil Pumps. Efficiency of Oil Pumps. Automotive Industries, vol. 56, no. 15, Apr. 16, 1927, p. 577. Tests on power consumption and volumetric efficiency of oil pumps as used on automobile aircraft engines made in the Mechanical Laboratory of Breslau Technical College; tests were made on vane-type pump from Hispano-Suiza aircraft engine and on two gear pumps from automobile engines; it was found that both mechanical efficiency and volumetric efficiency are dependent on viscosity of oil and on any leakage occurring. Translated from V.D.I. Zeit.

Superchargers. What Superchargers Will Do for Motor Vehicles, M. A. Hall. Automotive Mfr., vol. 69, no. 1, Apr. 1927, pp. 5-7 and 13. Advantages which may be expected when this method of forced feeding has been adapted to stock cars; how it works; economies.

AUTOMOBILES

Lubrication. Problems of Motor Car Lubrication, R. B. White. Oil & Gas Jl., vol. 25, no. 48, Apr. 21, 1927, pp. 143-144. Follies and mysteries of lubricating; troubles rightly or wrongly attributed to oil. Paper read before Am. Oil Men's Assn.

Schneider. The New Th. Schneider. Auto-Motor Jl., vol. 32, no. 1371, Apr. 14, 1927, pp. 317-318, 5 figs. General specification includes new overhead-valve engine, with monobloc cylinders and detachable head, and in unit with clutch and gear, whole being mounted in deep end rigid-pressed steel frame with substantial, gussetted cross-members and with upturned and rearwardly down-curved rear to clear axle and allow of good high-sided bodywork with low loading and low step-in.

AUTOMOTIVE FUELS

Anti-Knock. Methods of Measuring the Anti-knock Value of Fuels, H. K. Cummings. Soc. Automotive Engrs.—Jl., vol. 20, no. 5, May 1927, pp. 599-608 and (discussion) 608-613, 22 figs.

Combustion. Combustion of Liquid Fuels in Engines (Les combustibles liquides dans leur rapports avec les moteurs), M. Dumanois. Annales de l'Office National des Combustibles Liquides, vol. 2, no. 1, Mar. 1927, pp. 9-20, 4 figs. Author limits his discusssion to automobile and airplane engines and to fuels most commonly used, namely, gasoline, ethylene alcohol and methylene alcohol.

Producer and Methane Gas. The French Alternative Fuel Trials, W. F. Bradley. Motor Transport, vol. 44, no. 1152, Apr. 11, 1927, p. 431. Satisfactory results obtained with producer and methane gas; wide variety of machines and fuels.

AVIATION

Landing-Field Lighting. Handbook of Instructions for Airdrome Landing Field Floodlight Type A-1, W. T. Harding. Air Corps Information Circ., vol. 6, no. 583, Feb. 1, 1927, pp. 1-8, 9 figs. Used as ground aid for making emergency landings at night; its use is contemplated for assistance of those airplanes not equipped with landing lights or whose lights have failed; its function is to illuminate area of landing field sufficient for making safe and easy landing under service conditions.

B

BEARINGS

Anti-Friction. Anti-Friction Bearings on Railway Equipment, W. E. Symons. Ry. & Locomotive Eng., vol. 11, no. 4, Apr. 1927, pp. 100-102. Extensive application and their record on foreign railways.

Eccentrically Loaded. Eccentrically Loaded Bearings, C. S. Darling. Mech. World, vol. 81, no. 2103, Apr. 22, 1927, pp. 282-283, 4 figs. Notes on how far eccentricity can be carried without detriment to running qualities of bearing, surface of which differs in no way from that of ordinary symmetrically loaded bearing.

BEARINGS, ROLLER

Railway Cars. Journal Friction in Relation to Train Operation, H. E. Brunner and J. S. Tawresey. Ry. Age, vol. 82, no. 21, Apr. 23, 1927, pp. 1258-1260, 4 figs. Influence of roller bearings on acceleration at high speeds; their effect on brake action.

Rolling Mills. Roller Bearings for Rolling Mills. Engineering, vol. 123, no. 3197, Apr. 25, 1927, pp. 465-467, 10 figs. Results of investigations extending over several years, carried out by Skefco Ball Bearing Co. at their steel works in Sweden.

BELTING

Standardization of Specifications. Putting Power Belting Under Executive Control, W. Staniar. Indus. Mgmt. (N.Y.), vol. 73, no. 4, Apr. 1927, pp. 246-252, 5 figs. Standardization of belting specifications at Oakland motor car plant.

BELTS

Slip of. The Slip of Belts (Sur les glissement des courroies), R. Swyngedauw. Académie des Sciences—Comptes Rendus, vol. 183, no. 20, Nov. 15, 1926, pp. 859-861. Among successive positions taken by element of belt upon pulley, there is one having characteristic properties, namely, where belt speed passes through maximum when pulley is moving; this critical position and its determination for various conditions such as belt tension, angular velocity of pulley, etc., is considered, from which adherence or slip of belt is deduced.

BLOWERS

Regulations. Report of Committee on Blower Systems. Nat. Fire Protection Assn.—Advance Paper, 1927, 18 pp., 6 figs. Revisions of regulations on blower and exhaust systems, primarily for purpose of clarifying intent of certain sections of rules which have been misunderstood in field application, and include rewording and rearrangement of number of sections.

BOILER FEEDWATER

Treatment. Factors Bearing on Proper Water Treatment, D. C. Carmichael. Power Plant Eng., vol. 31, no. 9, May 1, 1927, pp. 505-509, 7 figs. Analysis of data collected in three plants to determine most important factors to be considered in treatment of feedwater.

BOILER FIRING

Low-Grade Coal. Utilizing Iowa's Coal Resources. Power Plant Eng., vol. 31, no. 10, May 15, 1927, pp. 558-559. Low-grade Iowa coal is being successfully used in both chain-grate and underfed stokers and in pulverized form, and its utilization is economic rather than mechanical problem.

BOILER FURNACES

Air Preheaters. Air Preheaters for Boilers, R. E. Butler. Engrs'. Soc. West Pa. Proc., vol. 42, no. 10, Jan. 1927, pp. 531-540 and (discussion) 540-542. Air preheaters, as to-day offered, may be classed under two general types, plate and tubular; rotative regenerative heater is only one form of plate-type heater; author's company has manufactured heaters of both types, but to-day is offering tubular heaters only, believing that this type best fills mechanical requirements of design.

Slag Prevention. Experiments with Furnace Slag Prevention, G. G. McVicker. Power, vol. 65, no. 20, May 17, 1927, pp. 743-744, 3 figs. After various methods of using salt had been tested, it was found that crucible of salt placed on shelf within furnace greatly reduced slag trouble on brickwork and tubes.

Wood-Waste Burning. Power from Wood and Combustible Refuse. Power Engr., vol. 22, no. 254, May 1927, pp. 165-166, 5 figs. Notes on practical furnace arrangements that have been found successful.

BOILER OPERATION

Separator for Purifying Steam. Purifying Steam with a Separator, C. E. Joos. Power, vol. 65, no. 19, May 10, 1927, p. 710, 1 fig. Installation of specially designed Cochrane receiver separators between steam drums and superheaters; since separator was installed it has not been necessary to replace single superheater tube and no deposits have accumulated.

BOILER PLANTS

Model. Model Boiler House at the British Industries Fair, Birmingham. Eng. and Boiler House Rev., vol. 40, no. 10, Apr. 1927, pp. 506-516, 8 figs. Exhibit included both water-tube and Lancashire boiler, each set up in position and coupled to their principal auxiliaries in working position.

BOILER PLATE

Annealing. The Annealing of Boiler Plate (Contribution à l'étude du recuit des tôles pour chaudières), S. P. Wologdine. Revue de Métallurgie, vol. 24, no. 2, Feb. 1927, pp. 64-67, 9 figs. Results of author's study; points out that distribution of stresses can vary greatly and depends on conditions of deformation. Translated from Russian.

BOILERS

Coke-Fired. Coke as a Boiler Fuel, E. W. L. Nicol. Eng. and Boiler House Rev., vol 40, no. 10, Apr. 1927, pp. 522-524. Deals with Lancashire boilers and sandwich systems for water-tube boilers.

Deterioration. Cause of Dangerous Boiler Deterioration, C. E. Stromeyer. Power, vol. 5, no. 17, Apr. 26, 1927, pp. 648-649. Prominence is given to uniform wasting, which is most misleading and dangerous corrosion to be met with in boilers, and has been cause of many disastrous explosions; incrustation; causes of failure of apparently sound plates, prominence being given to possibility of caustic embrittlement. Abstract of 1926 report of Manchester Steam Users' Assn. of London.

Internal Combustion. Internal vs. External Combustion Boilers, D. M. Mackay. Power Engr., vol. 22, no. 254, May 1927, pp. 183-185, 1 fig. Discusses relative advantages of various types of boilers with regard to internal combustion boiler.

Steam Loop. The Steam Loop and How It Operates. Power, vol. 65, no. 18, May 3, 1927, pp. 661-662, 2 figs. Consists of insulated riser connecting point to be drained to horizontal condenser located considerably above boiler and drop-leg, also insulated, connecting condenser with boiler drum below water line; used for conserving steam-line condensation.

Steaming Capacity. Methods of Increasing Steaming Capacity of Boilers. Power Engr., vol. 22, no. 254, May 1927, pp. 177-178. When shortage of steam occurs, and additional boiler cannot be purchased, existing plant can be made to meet increased demand.

Waste-Gas. A Determination of the Efficiency of an Exhuast Gas Boiler, G. Cook. Engineer, vol. 143, no. 3718, Apr. 15, 1927, pp. 403-404, 4 figs. Results of tests carried out on small waste-gas boilers constructed by Clarkeson Trumble Tube Boiler Co., fitted to 18-b.h.p. Crossley gas engine.

BRASS FOUNDRIES

American Furnaces. American Furnace Practice for Brass Foundries, H. M. St. John. Metal Industry (Lond.), vol. 30, no. 15, Apr. 15, 1927, pp. 386-388. Factors affecting refractory performance; furnaces using solid fuel; crucible furnaces using oil or gas; open-flame furnaces; indirect-arc electric furnaces; induction furnaces; high rate of production favourable; art of patching.

BRIDGE DESIGN

Graphic Charts. Graphic Charts and Their Use in Bridge Construction, H. D. Stover. West. Constrn. News, vol. 2, no. 8, Apr. 25, 1927, pp. 37-38, 2 figs. In design and preparation of plans for bridges where speed and accuracy are required, graphical representation of series of calculations often proves of great value; presents chart prepared for reinforced-concrete slab design with reinforcing at right angles to direction of traffic and chart.

BRIDGE ERECTION

Girder Span. Erection of a Girder Span Imposes Serious Problem. Ry. Eng. & Maintenance, vol. 23, no. 5, May 1927, pp. 194-196, 5 figs. By using existing trusses as means of supporting new girders during process of erection, four truss spans were replaced by seven girder spans without use of falsework and with no interruption to traffic; this operation was carried out in renewing superstructure of White River bridge on Indianapolis division of Pennsylvania R.R. near Seymour, Ind.

BRIDGE PIERS

Erection in Swift Current. Buffalo-Fort Erie Bridge Piers Built in Swift Current, R. W. Cady. Eng. News-Rec., vol. 98, no. 16, Apr. 21, 1927, pp. 638-640, 4 figs. Rock bottom and heavy current; floating caissons placed with help of steel sheet piles and spuds; caisson sealing presented difficulties.

BRIDGE STRENGTHENING

Welding. Welded Repairs to Princes Bridge, Melbourne. Engineer, vol. 143, no. 3718, Apr. 15, 1927, pp. 419-420, 7 figs. To strengthen and straighten web plates of main girders, it was decided to place new tee iron stiffeners at each side of web plates under each of traverse girders; they were welded to web plates and their ends welded to flanges at top and bottom.

BRIDGES, HIGHWAY

Cantilever. Counterweighted Cables Raise 433-Ft. Spans to High-Level Cantilever Bridge, C. F. Goodrich. Eng. News-Rec., vol. 98, no. 17, Apr. 28, 1927, pp. 686-689, 10 figs. Two 620-ton suspended spans for Carquinez Highway bridge were floated under structure and lifted by 2½-in. cables with counterweights.

Designing the Carquinez Cantilever Bridge, D. B. Steinman. Eng. News-Rec., vol. 98, no. 19, May 12, 1927, pp. 777-781, 5 figs. Economic studies determined type and proportions of structure comprising two 1,100-ft. spans; details include multiple-pin joints and hydraulic buffers to cushion longitudinal shocks.

BRIDGES, LIFT

Gas-Electric. New Gas-Electric Lift Bridge Now in Service. Eng. & Contracting, vol. 66, no. 4, Apr. 1927, p. 153. Built by Pennsylvania R.R. across Chesapeake and Delaware canal.

BRIDGES, RAILWAY

GIRDERS. An Obsolete Type of Bridge Girder. Ry. Engr., vol. 48, no. 568, May 1927, pp. 184-185, 1 fig. Study of old type of cast iron railway girder with attached wrought iron side rod.

LIFTING. Lifting the Kafue Bridge. Engineer, vol. 143, no. 3720, Apr. 29, 1927, pp. 478-479. Describes work of lifting a railway bridge in northern Rhodesia 1,398 ft. long and weighing 910 tons; bridge has 13 spans and is one of longest in Africa; by aid of 28 figures and hydraulic jacks, it was gradually lifted from its 20-year-old foundation; traffic was not stopped during operation.

BRIDGES, SUSPENSION

EYE-BAR CABLE. The Eye-Bar Cable Suspension Bridge at Florianopolis, Brazil, D. B. Steinman and W. G. Grove. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 707-783, 35 figs. Bridge, with main span of 1,113 ft. 9 in., is longest span bridge in South America and longest eye-bar suspension span in world; distinctive feature of construction is utilization of cable to replace part of top chord of stiffening truss, and consequent change from conventional parallel chord truss to stiffening truss of more effective outline; another departure from customary practice is use of rocker towers; instead of wire for cables, eye-bars are used made of newly developed, high-tension, heat-treated carbon steel, having yield point exceeding 75,000 lb. per sq. in., and intended to be used with working stress of 50,000 lb. per sq. in.

BRUSHES

CURRENT DIVISION AMONG. Causes, Effects and Curves of Unequal Division of Current Among Brush Groups, C. O. Mills. Power, vol. 65, no. 20, May 17, 1927, pp. 740-741, 2 figs. Unbalance of currents in brushes of d.c. machines may be cause not only of heating but also of sparking at brushes.

BUILDING CONSTRUCTION

STEEL AND CONCRETE FRAME. Composite Steel and Concrete Frame in Fayetteville Bank, W. Atlee. Eng. News-Rec., vol. 98, no. 19, May 12, 1927, pp. 771-772, 3 figs. Novel form of steel-frame construction was used in National Bank of Fayetteville, N.C., having trade name of "System S"; saving realized by using concrete girders with trusses as reinforcement, bracing and form supports.

BUILDINGS

INDUSTRIAL. The Relation of Building Design to the Manufacturing Process, C. P. Wood. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 573-580, 29 figs. Broad principles governing building projects; special features of building design, assuming process to have been perfected; descriptions of buildings for manufacture of soap, linoleum, plate glass and textiles, and for publishing magazines and newspapers.

C

CABLES, HOISTING

SAFE LOADING. Safe Loading of Cables, Chains and Eyebolts, N. L. Rea. Power, vol. 65, no. 18, May 3, 1927, pp. 667-669, 8 figs. When machinery parts are lifted, account must be taken of increased stresses in individual slings when load is lifted by two or more slings connected to crane hook and making an angle with each other.

CABLEWAYS

COAL CONVEYANCE BY. Coal Conveyance by Aerial Ropeway, H. Roe. Iron & Coal Trades Rev., vol. 114, no. 3085, Apr. 15, 1927, pp. 595-596, 2 figs. Dealing with question of transport from coal mine to port, aerial ropeway would frequently eliminate considerable amount of labour and save very appreciable amount of space at both terminal points; other advantages.

TYPES. Aerial Cableways (Les teleferiques). Vie Technique & Industrielle, vol. 9, no. 91, Apr. 1927, pp. 20-28, 22 figs. Notes on calculation and design, with examples of actual installations.

CAR WHEELS

GRINDING. Ground Car Wheels Assure Accuracy and Reduce Maintenance Costs. Abrasive Industry, vol. 8, no. 5, May 1927, pp. 160-163. Records and statements compiled after exhaustive tests by Norton Co. and mechanical engineers of railways; data show advantages of car-wheel grinding and indicates savings that can be made by use of grinding machine.

CAST IRON

ANNEALED. Mechanical and Machining Properties of an Annealed Cast Iron, G. C. Priester and F. J. Curran. Am. Soc. Steel Treating—Trans., vol. 11, no. 5, May 1927, pp. 741-759 and (discussion) 759-762, 9 figs. Results of study of machining and mechanical properties of cast iron used in manufacture of pistons when subjected to various annealing temperatures; machining properties of annealed pistons were studied in modern production plant and various processes are described; results of heat treatment, chemical analysis, machining properties, transverse tests, tensile and hardness tests, compressive and shear tests and effect of time on annealing; microstructure of test bars.

DESULPHURIZING. Sulphur and Desulphurization in Cast Iron, R. T. Rolfe. Iron & Steel Industry & Brit. Foundryman, vol. 1, no. 1, Apr. 1, 1927, pp. 3-6, 2 figs. Problem of sulphur in foundry practice, extent to which it is prejudicial, extent to which it may be harmless and associated problem of desulphurization, its ways and means.

DEVELOPMENTS. Recent Developments in Cast Iron and Foundry Practice. Brit. Cast Iron Research Assn.—Bul., no. 16, Apr. 1927, pp. 20-25. Regularity of cupola-melted cast iron; tests by Society of German Iron Founders to determine strength properties that should be prescribed in deliveries of cast iron.

HIGH TEMPERATURE, EFFECT OF. The Influence of High Temperatures on the Texture and the Mechanical Properties of Cast Iron. Foundry Trade Jl., vol. 35, no. 555, Apr. 7, 1927, pp. 303-304, 1 fig. Piwowarsky's results are confirmed by 13 series out of 15.

NICKEL IN. Nickel and Nickel-Chromium in Cast Iron, A. B. Everest. Brit. Cast Iron Research Assn.—Bul., no. 16, Apr. 1927, pp. 14-19. Review of published work; history of development of nickel cast iron; influence of nickel; special alloy cast iron; nickel-chromium cast iron. Bibliography.

CENTRAL STATIONS

DIESEL-ENGINED. The Panama Canal Diesel-Engined Power Plant. Mech. Eng., vol. 49, no. 5, May 1927, pp. 445-450, 12 figs. Design and data on tests of plant of 12,375-h.p. peak-load capacity, comprising three of largest Diesel engines yet built in America.

CHROME NICKEL STEEL

PROPERTIES AND HEAT TREATMENT. Facts and Principles Concerning Steel and Heat Treatment. H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 11, no. 5, May 1927, pp. 791-803, 2 figs. Composition, properties, uses and heat treatments of common types of chromium-nickel steels; low, medium and high chromium-nickel steels with carbon contents from 0.10 to 0.55 per cent; nickel-chromium heat-resisting alloys.

CHROMIUM STEEL

PROPERTIES. Chromium and Cobalt Steels (Note sur les aciers au chrome et au cobalt), F. M. Ostroga. Revue de Métallurgie, vol. 24, no. 3, Mar. 1927, pp. 135-145, 22 figs. Dilation tests; mechanical tests; principal characteristics of chromium and cobalt high-carbon steels; they oxidize only slightly at high temperature.

CLAY

SASKATCHEWAN. Why Can't Saskatchewan Supply Canada with Her Clay Products? Contract Rec., vol. 41, no. 15, Apr. 13, 1927, pp. 355-357. Province has exceptionally excellent clay resources from which can be manufactured all classes of ceramic products.

COAL

ASH, SOFTENING TEMPERATURE. Study of the Ash from Alberta Coals Reveals Many Interesting and Important Facts, A. G. Scroggie. Coal Age, vol. 31, no. 18, May 5, 1927, pp. 631-634, 1 fig. In general, there is no definite relation between softening temperature of coal ash and its colour, percentage of ash in coal, calorific value of fuel or its geological age.

BRIQUETTING. Low-Volatile Coal, If Satisfactorily Briquetted, Makes Excellent Domestic Fuel, T. Nagel. Coal Age, vol. 31, no. 18, May 5, 1927, pp. 638-640, 3 figs. Disintegration of coal during its mining and preparation, together with low return on slack, is major problem of industry; one solution lies in briquetting with phosphoric-acid binding compound.

CARBONIZATION. Low Temperature Carbonization, D. H. Lander and J. F. Shaw. Fuel Research—Tech. Paper, no. 17, 1927, pp. 1-7. Preliminary account of construction and behaviour of latest vertical cast iron retorts erected at Fuel Research Station for low temperature carbonization of bituminous coal.
Vertical Retorts for Low Temperature Carbonization at H.M. Fuel Research Station. Engineering, vol. 123, no. 3197, Apr. 22, 1927, p. 484, 4 figs. Review of Tech. Paper No. 17, issued by Fuel Research Station.

VOLATILE MATTER IN. Determination of Percentage of Volatile Matter in Coal (Détermination du pourcentage des matières volatiles dans les charbons), D. Waard. Chaleur & Industrie, vol. 8, no. 84, Apr. 1927, pp. 202-204, 3 figs. In 1922 Ryks-Institute of Holland confirmed fact that methods and machines for determining volatile matter in coal might lead to very different results, causes of which are herein discussed.

COLD STORAGE

PLANTS. Operating Methods in a Large Cold Storage Plant, F. P. MacNeil. Power, vol. 65, no. 19, May 10, 1927, pp. 698-700, 3 figs. Control of temperatures; measuring apparatus; operation of compound compressors; use of clearance pockets.

THERMOMETRIC LAG. Thermometric Lag, with Especial Reference to Cold Storage Practice, E. Griffiths and J. H. Awbrey. Refrig. Eng., vol. 13, no. 10, Apr. 1927, pp. 309-312, 5 figs. Discusses magnitudes of some of possible sources of error in determination of temperature of cold stores in ship's hold by means of mercury or spirit thermometer which is carried to deck for purposes of reading; effect of time lag upon reading of thermometer in case when temperature is changing rapidly. Reprint from Collected Researches, Nat. Physical Laboratory, vol. 19, 111, 1926.

COLUMNS

STRENGTH UNDER LOADING. Column Strength Under Eccentric and Shear Loading. Eng. News-Rec., vol. 98, no. 17, Apr. 28, 1927, pp. 682-684, 3 figs. Tests at Wisconsin throw light on influence of shear, eccentricity and strength of lattice and battens.

COMBUSTION

PULSATORY. Pulsatory Combustion (La combustion vibratoire), L. Mauge. Revue Industrielle, vol. 57, no. 2213, Apr. 1927, pp. 160-164, 2 figs. Speed of chemical reactions constituting combustion is directly proportional to total surface of contact between air and fuel in unit time; by imparting pulsations or vibrations to air, formation of inert layers of CO_2 stratification of air flow, and formation of chimneys through fuel bed are prevented: combustion is accelerated by production of lateral movement of air in fire bed, particularly in case of gas producers; when gas engine is arranged so that its pulsating suction operates on gas producer, consumption of anthracite may be reduced by 20 per cent; characteristic effects of pulsation are to produce more permeable fire bed, more rapid and uniform combustion and easier and more efficient operation. Deschamps pulsator is described. See brief translated abstract in Power Engr., vol. 22, no. 254, May 1927, p. 195.

CONCRETE

CONTROL. Practical Concrete, H. C. Badder. Roads and Road Constr., vol. 5, no. 51, Mar. 1, 1927, pp. 70-71. Specification clauses for control of concrete.

CONCRETE CONSTRUCTION, REINFORCED

COAL STORAGE. The Application of Reinforced Concrete to the Storage of Coal, V. H. Adams. Structural Eng., vol. 5, no. 4, Apr. 1927, pp. 115-121, 4 figs.

SLABS. Tests on Full-Size Slabs. Concrete and Constr. Eng., vol. 22, no. 4, Apr. 1927, pp. 252-254. Account of research work carried out by O. Graf at Technical High School at Stuttgart on strength of rectangular slabs of large scantling reinforced in different manners and submitted to uniform loading; results indicate that design of mesh-reinforced slabs as commonly carried out is open to question.

CONCRETING

PLANTS. Layout of Concreting Plants for Three Warehouses, L. C. Hammond. Eng. News-Rec., vol. 98, no. 18, May 5, 1927, pp. 730-733, 5 figs. Comparative studies give broad conclusions on delivery methods, mixer sizes, chute and buggy distribution and winter concreting.

CONDENSERS, STEAM

PERFORMANCE. Condenser Performance Improves Steadily. Power Plant Eng., vol. 31, no. 9, May 1, 1927, pp. 512-514, 5 figs. Reduction in surface, new methods of tube packing and cleaning, provisions for deaeration, form some of principal factors in recent developments.

PRACTICAL USE. The Practical Uses of Industrial Cost Accounting. P. M. Atkins. Indus. Mgmt. (N.Y.), vol. 73, nos. 4 and 5, Apr. and May 1927, pp. 210-213 and 290-295. In first place, cost reports may furnish information which is of importance in determination of various business policies, and, in the second place, it assists materially in the administration of policies which have already been initiated. Apr.: Setting of selling prices; cost analysis of lines of product; standardization of product; preparation of master schedule or budget. May: Cost data as a major tool of administration.

STANDARD COSTS. Installing Standard Costs, G. C. Harrison. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 329-332. Standard costs will ultimately supersede job-order cost system; forecast of profits; daily labour-efficiency report; compiling standard costs.

SURFACE. Surface Condensers in Steam Power Plants, J. A. Powell and H. J. Vetlesen. Mech. Eng., vol. 49, no. 5, May 1927, pp. 417-421, 20 figs. Study showing how most economical condenser installation for given power plant can be determined; based on average heat transfer actually obtained in condensers of different makes under normal operating conditions.

TUBES. Some Investigations into the Cause of Erosion of the Tubes of Surface Condensers, C. A. Parsons. Shipbldg. & Shipg. Rec., vol. 29, no. 15, Apr. 14, 1927, pp. 412-416 and (discussion) 446-449, 6 figs. Abstract of paper read at Instn. of Nav. Architects, Apr. 6. See also Engineer, vol. 143, no. 3717, Apr. 8, 1927, pp. 390-391, 8 figs.; and Engineering, vol. 123, no. 3195, Apr. 8, 1927, pp. 432-435, 7 figs.

CONDUITS

PRESSURE. Notes on European Practice in Penstock Design, O. Reed. Eng. News-Rec., vol. 98, nos. 18 and 19, May 5 and 12, 1927, pp. 718-721 and 773-776, 11 figs. May 5: Methods and details and construction of high-head penstocks, notably in Italy, Switzerland and Norway. May 12: Fabricating and testing penstocks.

CONNECTING RODS

DURALUMIN. Duralumin Connecting-Rod Machining Methods, F. H. Colvin. Am. Mach., vol. 66, no. 17, Apr. 28, 1927, pp. 697-699, 9 figs. Rough drilling and reaming small end; elongating large end; casting linings in centrifugal machine; grinding ends of bearings; sawing off cap.

COOLING TOWERS

REINFORCED-CONCRETE. Ferro-Concrete Cooling Towers, H. Dickinson. Ferro-Concrete, vol. 18, no. 10, Apr. 1927, pp. 252-256, 2 figs. Erected at Liverpool Corporation Electricity Works.

COPPER

ELECTROLYTIC REFINING. Twenty-Five Years' Progress in the Electrolytic Refining of Copper, S. Skowronski. Am. Electrochem. Soc.—Advance Paper, no. 33, for mtg. Apr. 28-30, 1927, pp. 333-339, 1 fig. Multiple system of refining is used more generally than series system; annual production of electrolytic copper in United States has increased to five times that of 1902; Cottrell precipitators are universally used for recovery of precious metals from refinery-plant fumes; casting furnaces have capacity up to 400 tons, as compared with 100 tons in 1902; oil and powdered coal have superseded soft coal as fuel; direct leaching of copper ores with subsequent electro-deposition has become very important factor.

CORROSION

JOINTS AND CREVICES. Corrosion at Joints and Crevices, U. R. Evans. Engineering, vol. 123, no. 3193, Mar. 25, 1927, pp. 362-363. Discusses older and newer electrochemical views of corrosion; deals with question of corrosion at submerged joints, which might be initiated by contact between dissimilar metals, or setting of differential aeration at joint; question of joints exposed to atmosphere. See also Roy. Soc. Arts—Jl., vol. 73, no. 3884, Apr. 29, 1927, pp. 544-562 and (discussion) 562-567, 2 figs.

CRANES

TURNTABLE ARRANGEMENTS. Turntable Arrangements for Jib Cranes, E. G. Fiegehen. Mech. World, vol. 81, no. 2104, Apr. 29, 1927, pp. 299-300, 5 figs. Design admits of many interesting variations, depending upon capacity of crane, space available, nature of service and quality of construction desired.

D

DAMS

ARCH. Bullards Bar Dam, North Fork of Yuba River, California, C. W. Faries. West. Constr. News, vol. 2, no. 8, Apr. 25, 1927, pp. 39-41, 2 figs. It is unique in that it has greater height of free overfall than any other dam, and that it is highest dam that has been designed to be filled to its crest with sand and gravel; this is first permanent structure of magnitude built for restraint of débris since enforced cessation of hydraulic mining in late eighties.

CONCRETE. Cushman Project Provides Large Storage at Low Cost, B. E. Torpen. Eng. News-Rec., vol. 98, no. 15, Apr. 14, 1927, pp. 608-611, 8 figs. Arch dam 250 ft. high raises level of Lake Cushman forming reservoir of 460,000 acre-ft. capacity; only 90,000 cu. yd. concrete in dam.

CONCRETE PROPORTIONING. Concrete Mix Designing on an Oklahoma Dam, W. L. Benham. Eng. News-Rec., vol. 98, no. 16, Apr. 21, 1927, pp. 655-657, 5 figs. How water-cement ratio method of proportioning worked out in building Lugert dam; conclusions and recommendations. Abstract of paper presented to Kansas City Engrs'. Club.

CONSTANT-ANGLE ARCH. Setting Form Points on Constant-Angle Arch Dams, B. T. Millard. Eng. News-Rec., vol. 98, no. 15, Apr. 14, 1927, pp. 618-619, 1 fig. Method well suited to dams exceeding 100 ft. in height expedites and simplifies engineer's field work.

CROSS-SECTION. A Comparison of the Cross-Sections of Some Well-Known Dams, C. W. Faries. West. Constr. News, vol. 2, no. 7, Apr. 10, 1927, pp. 47-49, 2 figs. Shows reasons for such differences in results after application of same theory.

EARTH. Another Earth Dam Built on Deerfield River, L. Gurney. Eng. News-Rec., vol. 98, no. 17, Apr. 28, 1927, pp. 678-682, 9 figs. One hundred-foot dam built by modified hydraulic-fill method in one working season; river by-pass and intake both carried through dam in concrete conduits.

Profiles of Earth Dams When Clay is Partly or Wholly Used in the Embankment, A. R. Pollard. Instn. Civ. Engrs.—Sessional Notices, no. 4, May 1927, pp. 98-102, 6 figs. Crosthwaite's experiments dealt with internal resistance of clay as whole; Terzaghi analyzed forces that go to make up this resistance; it seems reasonable to assume that internal resistances measured by Crosthwaite were resultants of these forces.

DIESEL ENGINES

CYLINDER LUBRICATION. Methods of Lubricating Power Cylinders of Diesel Engines, W. O. Northcutt. Oil and Gas Jl., vol. 25, no. 47, Apr. 14, 1927, pp. 170-175, 1 fig. Offers constructive criticism of present methods of applying lubricating oil to power cylinders of Diesel engines and recommends method which, writer believes, will be improvement over present method. Paper read before Petroleum Division, Am. Soc. Mech. Engrs.

EXHAUST TEMPERATURES. Diesel Exhaust Temperatures, V. L. Maleev. Power, vol. 65, no. 20, May 17, 1927, p. 760. Results of series of tests performed with three oil engines, all of same make; finds relation between engine load and exhaust temperatures.

INDICATOR DIAGRAMS. Diesel Engine Indicator Diagrams. Mar. Engr. & Motorship Bldr., vol. 50, no. 597, May 1927, pp. 192-194, 1 fig. Survey of uses to which indicator diagrams taken from main engines of a motorship can be put.

RAILWAY TRACTION. Diesel Traction for Railroads, W. Arthur. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 581-586, 7 figs. General considerations; advantages of "Dieselizing" certain railroad services; operating, design and construction problems; weights and speeds; cooling, transmission and vibration problems; maintenance; fuel consumption; general conclusions favouring adoption of Diesel-electric traction.

DRILLING MACHINES

HEAVY-DUTY. A New Heavy-Duty Drilling Machine. Brit. Machine Tool Eng., vol. 4, no. 44, Mar.-Apr. 1927, pp. 565-569, 6 figs. Archdale centralized-control vertical drilling machine embodies numerous features typical of trend of the latest practice in machine-tool design.

VERTICAL-JIG. Vertical-Jig Drilling and Boring Machine. Engineering, vol. 123, no. 3193, Mar. 25, 1927, p. 352, 14 figs. partly on supp. plate. Can be used either with drill or with boring bar, and, by means of its built-in measuring devices on table, tool can be centred on work to ten-thousandth of inch; constructed by Pratt & Whitney Co., Hartford, Conn.

E

EDUCATION, ENGINEERING

CO-OPERATIVE METHOD. The Co-operative Method of Engineering Education. Jl. Eng. Education, vol. 17, no. 7, Mar. 1927, pp. 669-735, 7 figs. Appraisal of system employed at University of Cincinnati; presents important facts relating to co-operative courses; analyzes those facts in relation both to methods and to principles involved. Bibliography.

CURRICULA. Curriculum Revision in the Light of the Board's Recommendations, W. E. Wickenden. Jl. Eng. Education, vol. 17, no. 8, Apr. 1927, pp. 792-801. Preliminary report of Board of Investigation and Co-ordination includes group of suggestions and recommendations concerning curricula; staff has been examining some of specific problems involved in giving effect to these proposals and has embodied some of its ideas provisionally in schematic group of curricula and certain notes which are set forth to stimulate study and discussion.

HENRY FORD TRADE SCHOOL. A Description of the Henry Ford Trade School, F. E. Searle. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 570-572. Particulars of successful, self-supporting trade school with 1,700 students who work two weeks out of three in school shop, devote third week to course of study, and who each receive from $450 to $1,000 annually.

GENERAL MOTORS INSTITUTE OF TECHNOLOGY. The General Motors Institute of Technology, A. Sobey. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 553-557, 8 figs. Particulars of educational programme designed to provide General Motors Corp. with supply of highly skilled service men and trained workers for plants and to furnish broad technical training for its future executives.

ELECTRIC CIRCUITS

CURRENT ANALYSIS. Current Analysis in Circuits Containing a Resistance Modulator, L. S. Grandy. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 5, May 1927, pp. 426-430, 5 figs. Function of resistance modulator is to produce in electric circuit current which is copy of an exciting impulse such as speech or light waves; principal example is carbon granule telephone transmitter; there is inherent in such device distorting effect; study quantitatively analyzes this distorting effect by two methods; shows that relation beween modulators and circuits is design problem.

ELECTRIC DISTRIBUTION SYSTEMS

SECTIONALIZING CIRCUITS. Sectionalizing Circuit in Case of Trouble, V. W. Palen. Power Plant Eng., vol. 31, no. 10, May 15, 1927, pp. 566-569, 3 figs. Operating procedure used by large power company to isolate damaged sections of their distribution system.

ELECTRIC FURNACES

HIGH-FREQUENCY. High-Speed High-Frequency Inductive Heating, E. F. Northrup. Am. Electrochem. Soc.—Advance Paper, no. 50, for mtg. Apr. 28-30, 1927, pp. 497-513, 5 figs. High-frequency inductive heating permits of almost unlimited speed of heating of continuous conducting mass; new 300-lb. commercial alloy-melting furnace is specially designed for melting ferrous alloys; very rapid heating gives very high melting efficiency.

MIGUET. The Miguet Electrode and the Miguet Furnace, M. Arrouet. Am. Electrochem. Soc.—Advance Paper, no. 36, for mtg. Apr. 28-30, 1927, pp. 351-354, 1 fig. Author shows that when properly designed large single-phase furnaces are practical and will operate efficiently; feature of new furnace is author's improved continuous electrode of large cross-section; bottom of electrode is about 20 cm. above bath, leaving spacious zone for carrying out various reactions, such as refining and alloying.

ROTATING-ARC TYPE. Rotating-Arc Furnace (Four électrique a arc tournant), G. E. Evreinoff and S. Y. Telny. Revue de Métallurgie, vol. 24, no. 2, Feb. 1927, pp. 57-63, 11 figs. Details of furnace developed by authors, employing characteristics obtained by use of exciting coil to cause rotation of arc; same principle can be applied to other types of electric furnaces, including Heroult and Girod. Translated from Russian.

ELECTRIC GENERATORS, A.C.

LOAD DIVISION BETWEEN. Load Division Between Alternators, F. D. Newbury. Elec. Jl., vol. 24, no. 5, May 1927, pp. 211-213, 3 figs. Load division between two engine- or turbine-driven alternators in parallel is dependent solely upon governors of their prime movers; governor setting affects load division through its effect on speed regulation.

ELECTRIC GENERATORS, D.C.

LOCATING TROUBLES. Locating Troubles in Direct-Current Machines, C. O. Mills. Power, vol. 65, no. 18, May 3, 1927, pp. 663-66, 9 figs. Improperly adjusted brushes, armature out of centre of polar space, unequally spaced field poles, defective castings and other defects have been cause of baffling sparking at brushes; shows effects of these faults and explains how to remedy them.

ELECTRIC MOTORS, A.C.

SYNCHRONOUS. Operation of Synchronous Motor as Part of a Set, R. L. Findley. Elec. Jl., vol. 24, no. 5, May 1927, pp. 198-202, 14 figs. Constant voltage and excitation; varying voltage, constant excitation; constant voltage, varying excitation; graphical solution for performance of synchronous motor under these three most common conditions of operation; necessary data are no-load saturation curve, full-load zero power-factor saturation curve, effective and d.c. armature resistance, field resistance friction and windage and core loss at various voltages.

ELECTRIC SWITCHES

AIR-BREAK. Pole-Top Switch Tests, R. C. R. Schulze. Elec. World, vol. 89, no. 16, Apr. 16, 1927, pp. 799-803, 3 figs. Series of tests on various makes of air-break switches carrying currents up to 480 amp. at 22,000 volts indicates desirable design features to meet operating conditions.

ELECTRIC TRANSMISSION LINES

BAUM TRANSMISSION PRINCIPLE. Baum Principle of Transmission, C. L. Fortescue. Elec. World, vol. 89, no. 19, May 7, 1927, pp. 954-960, 3 figs. Method devised to increase power transmitted over given line; 1,000-volts-per-mile rule replaced by square of transmission voltage rule.

CONSTRUCTION IN SWAMP. 66-Kv. Line Built Through a Swamp, B. H. Cutler. Elec. World, vol. 89, no. 18, Apr. 30, 1927, pp. 917-918. Construction problem encountered by Hoosier Engineering Co. in building line for Florida Power Corp. from Ocala to High Springs; difficulty arose in getting across 13,000-acre lake or swamp with average depth of 7 ft. and thickly overgrown with hyacinths.

INTERCONNECTION. How Interconnection Saved the Day, R. L. Shepherd. Elec. World, vol. 89, no. 20, May 14, 1927, pp. 1006-1010. Light and power companies in flooded Mississippi regions are enabled to maintain service because of their extensive networks; emergency lines installed and repairs made without regard to danger.

TOWERS. Towers for High-Tension Transmission Lines, H. R. White. Structural Eng., vol. 5, no. 4, Apr. 1927, pp. 98-107 and (discussion) 107-110. Brief review of what has been done up to present, particularly in United States and Canada; endeavours to show that it is engineering problem in every sense, and not to be confused with telegraph or telephone lines even on large scale.

ELECTRIC WELDING, ARC

ADVANTAGES. Arc Welding, J. F. Lincoln. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 558-560, 7 figs. Advantages of arc-welded steel parts over those of cast iron or of riveted construction; savings in cost effected by replacing iron castings with arc-welded steel parts; inconsistency of permitting arc welding in superheaters and steam piping and forbidding it in boilers, etc.

AUTOMOBILE BODY ASSEMBLY. Electric Arc Welders Used in Willys-Knight Body Assembly Line. Automotive Industries, vol. 56, no. 15, Apr. 16, 1927, p. 595, 1 fig. Found advantageous in formation of joint between cowl sheet and stamped truss bar forming foundation of windshield frame.

ELECTRIC WIRING

SYSTEMS. The Ideal Wiring System, H. R. Taunton. Elec. Rev., vol. 100, no. 2579, Apr. 29, 1927, pp. 670-672. Comparison of several wiring systems that are available with view to deciding which, in author's opinion, approaches nearest to ideal for ordinary domestic wiring.

ELEVATORS

GEARLESS. High-Speed Gearless Elevators. Commonwealth Engrs., vol. 14, no. 8, Mar. 1, 1927, pp. 307-311, 6 figs. Two elevators installed in head offices of Victorian State Savings Bank, Elizabeth Street, Melbourne; elevators are of gearless type, i.e., gear or other speed-reducing device is employed between motor and rope-driving sheave, latter being mounted direct upon armature shaft.

EMPLOYEES, TRAINING OF

ROLLING MILLS. Train Employees for Better Jobs, B. Finney. Iron Age. vol. 119, no. 19, May 12, 1927, pp. 1357-1359. Courses in educational programme of American Rolling Mill Co. cover wide range of subjects; instruction in hands of practical men.

EMPLOYMENT MANAGEMENT

PROBLEMS OF STAFF MEN. Personnel Problems of Staff Men in Industry, A. B. Rich. Taylor Soc.—Bul., vol. 7, no. 2, Apr. 1927, pp. 375-376. Staff men in industry are defined as those specialists in various fields of management who are not responsible for operating activities, usually referred to as personnel managers, chemical and industrial engineers, chemists, etc.; enumerates characteristics that staff man must cultivate.

RATING SCALE. Rating a "Rating Scale," D. Fryer. Indus. Mgmt. (N.Y.), vol. 73, no. 5, May 1927, pp. 301-302, 1 fig. Selection of specific traits for rating; real purpose of rating scale.

F

FANS

POWER REQUIRED. How to Figure Power Required to Drive Fans. Power, vol. 65, no. 19, May 10, 1927, pp. 708-709. 2 figs. Assuming fan of proper size has been selected and curve of fan efficiency has been obtained from fan manufacturer, power required to drive fan may be computed by dividing air horse power by fan static efficiency.

FATIGUE

INDUSTRIAL. Eliminating Fatigue Losses, F. Hahn and S. F. Csohar. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 373-374, 5 figs. Application of physical laws to anatomical motions and their relation to fatigue and production.

FILTRATION PLANTS

DISSOLVED-OXYGEN CHANGES. Dissolved-Oxygen Changes During Filtration, W. U. Gallaher. Am. Water Works Assn.—Jl., vol. 17, no. 4, Apr. 1927, pp. 476-480, 1 fig. In connection with experiments conducted at Highland Park water-filter plant to locate cause of air binding in filters, dissolved-oxygen was run on sample of water entering filter bed and also on sample taken from effluent pipe of same filter; there was decrease in dissolved-oxygen, even though filter on being washed did not show any entrapped air.

FIRE FIGHTING

STANDPIPE AND HOSE SYSTEMS. Report of Committee on Field Practice. Nat. Fire Protection Assn.—Advance Paper, 1927, pp. 1-12. Presents revisions in regulations for installation of standpipe and hose systems.

FIREBRICK

STEAM, EFFECT OF. The Effect of Steam on the Transverse Strength of Fireclay Bricks, C. W. Parmelee and A. E. R. Westman. Am. Ceramic Soc.—Jl., vol. 10, no. 4, Apr. 1927, pp. 292-298, 1 fig. Experiments in which standard straight bricks at 1,100 deg. cent. were subjected to action of steam at same temperature and resulting change in transverse strength measured; no significant decrease in strength due to action of steam alone was found.

FITS

METAL, CHARTS FOR. Tolerance and Allowance Charts for Metal Fits, T. F. Githens. Mech. Eng., vol. 49, no. 5, May 1927, pp. 414-415, 8 figs. Series of charts graphically showing information tabulated in issue by A.S.M.E. Section Committee of Plain Limit Gauges for convenience of those who find it preferable to use charts instead of tables of figures.

FLOW OF AIR

DUCTS. Experiments on the Flow of Air in Ducts (Fifth Report of the Midland Institute Committee on the Ventilation of Mines), W. E. Cooke and C. F. Statham. Instn. Min. Engrs.—Trans., vol. 73, part 1, Mar. 1927, pp. 78-95 and (discussion) 95-105, 13 figs. partly on supp. plate. Experiments on square duct in mining laboratory of University of Sheffield, 4 ft. in diameter; comparisons of results and conclusions.

FLOW OF FLUIDS

MEASUREMENT. The Calculation of Difference of Pressure by Means of Measuring Apparatus for Water, Vapour and Gas (Calcolo dei misuratori a differenza di pressione per acqua vapore e gas), G. Conti and C. Spadon. Ingegnerio, vol. 5, no. 8, Aug. 1926, pp. 282-290, 9 figs. Deals specially with Venturi meters extended to disk and diffusor apparatus of measurement. See translated abstract in Refrig. Eng., vol. 13, no. 9, Mar. 1927, p. 287.

RESISTANCE MEASUREMENT. The Correct Measurement of Resistance, E. Ower. Colliery Eng., vol. 4, no. 38, Apr. 1927, pp. 162-164. 2 figs. Analysis of errors incurred in usual methods of measuring mean total head in duct with view to the determination of resistance.

FLOW OF GAS

HIGH-PRESSURE LINES. Gas Flow Through High-Pressure Lines, E. L. Rawlins. Oil & Gas. Jl., vol. 25, no. 48, Apr. 21, 1927, pp. 40 and 154. Formulas for use in designing lines; problem being considered by Government and Natural Gas Assn. Paper read before Natural Gas Assn. of America.

FLOW OF LIQUIDS

TUBES. Theoretical Formula for Determining the Loss of Head of a Liquid Flowing in a Circular Tube, L. Leibenzon. Petroleum Industry (Russia), vol. 12, no. 3, Mar. 1927, pp. 386-394, 5 figs. Theoretical formula is deduced for coefficient for determining loss of head of liquid moving in round tube; investigation is based on existence of boundary layer and on distribution of velocities in cross-section of tube. (In Russian.)

FLOW OF WATER

CONDUITS. Formulas for the Flow of Water in Large Pressure Conduits and Aqueducts (Note sur diverses formules relatives à l'écoulement de l'eau dans les conduits et les aqueducs de grandes dimensions), M. Hubie. Annales des Ponts et Chaussées, vol. 97, no. 1, Jan.-Feb. 1927, pp. 5-22, 2 figs. Comparison of most commonly used formulas for pressure discharges; study of experiences and new formulas employed in America; author presents table based on these formulas, to facilitate their employment and to permit comparisons with French formulas.

FORGINGS

BRASS. Brass Forgings, O. J. Berger. Brass World, vol. 23, no. 4, Apr. 1927, pp. 111-112. Reasons for their growing popularity; comparisons between forgings and castings; types of equipment needed and heating requirements.

FOUNDATIONS

DEEP PITS. The Deepest Foundation Pits on the Continent, F. W. Skinner. Contract Rec., vol. 41, no. 17, Apr. 27, 1927, pp. 404-406, 3 figs. Concrete piers for large building in Cleveland, with tower rising 708 ft. above ground, were built in open wells excavated to rock 260 ft. below original surface.

FOUNDRIES

CONTROL. Advantages of Foundry Control, H. J. Young. Foundry Trade Jl., vol. 35, no. 558, Apr. 28, 1927, pp. 357-359. Controlling raw materials; high-priced irons must be chemically uniform; economies achieved; Perlit process; dirt and castings; draw holes and other defects; inefficient chaplets; views on costing.

FOUNDRY EQUIPMENT

SAND MIXERS. A New Sand Mixer and Aerator. Foundry Trade Jl., vol. 35, no. 557, Apr. 21, 1927, pp. 337-338, 1 fig. Novel form of machine supplied by Universal System of Machine Moulding and Machinery Co., London; which combines function of disintegrator, mixer, aerator, and, within limits, also conveyor; it is entirely self-contained unit mounted with its driving motor on common base which is fitted at fore-end with pair of travelling wheels, and at rear with sockets for reception of handles.

FREIGHT HANDLING

UNBOXED SHIPMENTS. Reducing Shipping Costs, G. F. Bauer. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 349-352, 5 figs. Automobile manufacturers start using steamers equipped to handle unboxed assembled cars and tractors; if automobiles, with their easily injured parts and delicate finish, can be shipped unboxed without damage and at less expense, so can machines; many wasteful methods now followed in domestic shipments may also be improved by adapting carriers to freight.

FUELS

COAL. *See Coal.*

LOW-GRADE. The Increasing Use of Low-Grade Fuels, D. Brownlie. Eng. and Boiler House Rev., vol. 40, no. 10, Apr. 1927, pp. 516-518. Applies not only to more familiar material, such as small coal washery settlings, coal screenings, etc., but also to all kinds of material in many countries, such as green wood and general vegetable material, brown coals and lignites, raw shale and bituminous tar sands.

OIL. *See Oil Fuel.*

FURNACES, INDUSTRIAL

DESIGN. Industrial Furnaces, C. Longenecker. Iron Trade Rev., vol. 80, nos. 3, 7, 9, 13 and 15, Jan. 20, Feb. 17, Mar. 3, 31 and Apr. 14, 1927, pp. 205-207, 450-452, 575-577, 824-825 and 964-966, 54 figs. Treatise on design, construction and function of modern melting, heating and treating units. Reheating or finishing furnaces.

RECUPERATORS. Recuperators for Industrial Furnaces, W. Trinks. Engrs'. Soc. of West. Pa.—Proc., vol. 42, no. 10, Jan. 1927, pp. 465-490 and (discussion) 491-509, 16 figs. Discusses two cardinal questions: (1) Does it pay to use recuperators? (2) Can recuperators be built so that they are cheap, simple and durable? Types of recuperators; advantage of stack type.

STRUCTURAL ELEMENTS. Notes on the Structural Elements of Industrial Furnaces, A. E. Perkins. Mech. World, vol. 81, no. 2097, Mar. 11, 1927, p. 173. Shows how few simple calculations can enable anyone to provide adequate strength to meet forces that are at work in all industrial furnaces.

G

GAS ENGINES

BEDS, HANDLING AND MACHINING. Handling and Machining a Big Gas Engine Bed, E. H. Brinker. Am. Mach., vol. 66, no. 17, Apr. 28, 1927, pp. 687-688, 4 figs. Transporting casting from foundry to machine shop; using 48-in. planer as draw-cut shaper; shipping finished piece.

GEAR CUTTING

INDEXING FIXTURE. An Indexing Fixture for Cutting Gears, P. W. Nielson. Am. Mach., vol. 66, no. 19, May 12, 1927, pp. 790-791, 1 fig. With this fixture it is possible to cut gears up to 6-in. outside diameter on old plain horizontal milling machine; all of movable parts are carried upon head that swings upon trunnions in base casting so that fixture is available to cut either plain spur or bevel gears.

GEARS

CHUCKING. Chucking Bevel Pinions and Gears. West. Machy. World, vol. 18, no. 4, Apr. 1927, p. 169. Accurate device for holding bevel-gear pinions by use of sets of taper rolls placed at three points of circumference which enter spaces between teeth and locate gear in correct position according to pitch line.

GIRDERS

LATTICE, SECONDARY STRESSES. Note on the Secondary Stresses in Lattice Girders, R. Desprets. Int. Ry. Congress—Bul., vol. 9, no. 4, Apr. 1927, pp. 277-290, 13 figs. Summarizes latest information on subject available in Anglo-Saxon countries.

GOLD DEPOSITS

ONTARIO. The Kenora Gold District, Ontario, S. H. Brokunier. Can. Min. Jl., vol. 48, no. 15, Apr. 15, 1927, pp. 302-303. Conclusion reached after testing these ores is, that 30 per cent must be added to any former bullion recovery, in order to get at gold value now recoverable; additional 30 per cent represents progress that modern ore dressing and modern mill recovery have made in past 25 years.

GRINDING

INTERNAL. Savings Made by Internal Grinding. West. Machy. World, vol. 18, no. 4, Apr. 1927, pp. 153-155, 5 figs. Large quantity production not always necessary to show satisfactory savings on this type of grinding.

LOCOMOTIVE PARTS. Finish British Locomotive Parts by Grinding, V. Delport. Abrasive Industry, vol. 8, no. 5, May 1927, p. 149, 4 figs. Operations of grinding locomotive motion rods and slidebars.

Refinish Locomotive Parts with Precision Abrasive Tools, B. K. Price. Abrasive Industry, vol. 8, no. 5, May 1927, pp. 142-144, 4 figs. Describes machines and operations at a large eastern shop.

GRINDING

RAILWAY REPAIR SHOPS. Abrasive Tools Expedite Locomotive Repair Operations, H. R. Simonds. Abrasive Industry, vol. 8, no. 5, May 1927, pp. 156-158, 3 figs. In large Readville shops of New York, New Haven & Hartford R.R., repairs are standardized; grinding operations.

Grinding Methods of Railroad Shops, H. Rowland. Can. Machy., vol. 37, no. 17, Apr. 28, 1927, pp. 13-15, 8 figs. Outline of grinding operations, including grinding piston rods, axle and motion pins, special grinding attachment.

H

HARDNESS

TESTING. Hardness Testing of Steel Balls by Magnetic Methods, S. R. Williams. Am. Soc. Steel Treating—Trans., vol. 11, no. 5, May 1927, pp. 677-690 and 823, 7 figs. In former paper published in same journal a magnetic method for testing hardness of steel balls was described; present paper deals with improvements in that method and better technique in manipulation as now worked out for outfit.

HEAT

CONDUCTION. Some Problems in the Conduction of Heat, G. Green. Lond., Edinburgh and Dublin Philosophical Mag. & Jl. of Science (Supp. no.), vol. 3, no. 16, Apr. 1927, pp. 784-800. Draws attention to method specially suited to such problems and gives one or two of fundamental solutions required in applying method; main idea underlying method employed is to treat all heat-conduction problems as problems in wave-motion.

HEAT TRANSMISSION

REFRIGERATION FIELD. Status of Heat Transmission Data and Knowledge in the Refrigeration Field, P. Nicholls. Refrig. Eng., vol. 13, no. 9, Mar. 1927, pp. 276-281. Deals mainly with such principles of flow as involve heat flow through non-metallic materials, although some fluid to solid transmission must necessarily be included.

HEAT TREATMENT

OXY-ACETYLENE FLAME. Heat Treatment by the Oxy-Acetylene Flame, E. E. Thum. Welding Engr., vol. 12, no. 4, Apr. 1927, pp. 35-38, 7 figs. Torch not only provides convenience but furnishes clean, uniform high heat, which is great advantage in this work; hardening of small tools; emergency annealing; relationships between metal and flame; drawing or tempering; hardening of malleable iron.

HEATING AND VENTILATION

AIR INFILTRATION. How to Figure Infiltration, C. F. Wolfsfeld. Heat. & Vent. Mag., vol. 24, no. 5, May 1927, pp. 65-68, 8 figs. Effect of wind velocity and direction, tightness of window, storm sash and new types of construction and other factors.

HEATING, STEAM

LOW-PRESSURE. Typical Defects in Low-Pressure Heating Systems and Suggested Remedies, C. C. Custer. Nat. Engr., vol. 31, no. 5, May 1927, pp. 219-221, 5 figs. Corrosion of return mains; care of water column; layout wherein check valves are not needed in returns.

SYSTEMS. Pressure Differences in Steam Heating Systems and Their Bearing on Operation—A Comparative Test of Two Types of Heating Systems, C. A. Dunham. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 4, Apr. 1927, pp. 225-231 and (discussion) 231-232. Test demonstrates that differential vacuum-heating system is more efficient than two-pipe gravity system in: closely proportioning heat emission from radiators to heat loss from the building; reducing operating costs and maintaining comfortable room temperatures; quantity of condensate required decreases more proportionately as temperature difference decreases in differential vacuum-heating system than in two-pipe gravity-heating system; cost of heating decreases for both systems as temperature difference decreases, rate of decrease being more rapid for differential vacuum-heating system.

HIGHWAYS

COASTAL. Six Counties Combine to Build 155-Mile Coastal Highway, F. M. Garnett. Eng. News-Rec., vol. 98, no. 17, Apr. 28, 1927, pp. 690-692, 4 figs. Country through which highway runs is low coastal plain made up of many swamps, marshes and sand flats, deeply cut by numerous tidal estuaries.

SAFETY. Highway Safety. Pub. Wks., vol. 58, no. 5, May 1927, pp. 159-162, 5 figs. More than 100,000 persons have been killed in automobile accidents in United States during past five years; part of such loss can be prevented by education and enforcement of wise traffic regulations; no regulations can be highly effective unless designing, constructing and maintaining of highways be performed with definite purpose continuously in mind to make them as nearly accident-proof as possible; what several state highway departments are doing along this line.

HYDRAULIC TURBINES

CAVITATION. Cavitation in Hydraulic Turbines (La Cavitation danes les turbines hydrauliques). Bul. Technique de la Suisse Romande, vol. 53, no. 7, Mar. 26, 1927, pp. 79-81, 5 figs. Review of paper by J. Hybl read before Academy of Science of Czecho-Slovakia, analyzing phenomena of cavitation.

DESIGN. The Efficiency of Hydraulic Turbines and Its Relation to Size of Turbine, Heat and Temperature (Verkningsgraden hos vattenturbiner och dess beroende av turbinstorlek, fallhöjd och temperatur), C. G. Haeger. Teknisk Tidskrift (Mekanik), vol. 57, no. 15, Apr. 16, 1927, pp. 49-52. Discusses Camerer's formula for calculation of increase in efficiency of geometrically similar turbines with increased diameter; refers to work of Hopf and Fromm.

SPECIFIC SPEED. Specific Characteristics for Hydraulic Turbines, A. Pfau. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 517-520, 1 fig. Suggested new expression for specific speed that is non-dimensional and embraces three fundamental characteristics of turbine; namely, peripheral-speed coefficient, velocity-of-flow coefficient and efficiency.

TESTING. Hydraulic Turbine Tests by the Allen Method, C. M. Allen. Power Plant Eng., vol. 3., no. 10, May 15, 1927, pp. 549-551, 9 figs. Electrical conductivity of salt solution forms basis of method which gives required test accuracy without use of coefficients or empirical formulas.

HYDRO-ELECTRIC DEVELOPMENTS

IRELAND. The Shannon Power Develoment, G. Garbotz. Eng. Progress, vol. 8, no. 4, Apr. 1927, pp. 85-90, 11 figs. Plant will have mean annual output of 462 million kw-hr. which will be used for distribution of power in Irish Free State; work is being carried out by Siemens-Schuckert Works; problems of transportation and power economy during construction.

ONTARIO. Power Developments on Gatineau River. Can. Engr., vol. 52, no. 15, Apr. 12, 1927, pp. 417-419, 6 figs. Good progress being made with construction work at Chelsea, Farmer's Rapids and Paugan Falls for Gatineau Power Co.; storage reservoir at Lake Baskatong will regulate flow of river; large paper mill at Chelsea.

Twelve Years of Hydro in Ontario, G. J. Mickler. Elec. News, vol. 36, no. 8, Apr. 15, 1927, pp. 31-34, 7 figs. Graphical analysis of domestic and commercial services showing great increase in consumption and larger monthly bills with cheaper power.

STATUS OF. The Hydro-Electric Power Era, W. H. Onken, Jr. Elec. World, vol. 89, no. 20, May 14, 1927, pp. 1003-1005. Increasing economy of modern steam-generating stations is reducing commercial attractiveness of many hydro-electric developments; those that are developed must be fitted into existing systems.

HYDRO-ELECTRIC PLANTS

QUEBEC. More Power in the Laurentian District, W. Evans. Elec. News, vol. 36, no. 9, May 1, 1927, pp. 31-33, 5 figs. East Branch Development No. 1 at Mont Rolland, P.Q., one of series of hydro-electric plants of Quebec Southern Power Corp.

RACKS AND HEADGATES. Rack Structure and Headgates of Cedar Creek Hydro-Electric Station, W. S. Lee. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 521-523, 8 figs. Design of rack structure and of type of headgate adopted for water intake at station of Duke Power Co. on Cattawba River, near Great Falls, S.C.

I

ICEBERGS

THERMIT MELTING. Thermit and Icebergs, H. T. Barnes. Franklin Inst.—Jl., vol. 203, no. 5, May 1927, pp. 611-634, 18 figs. Thermit heat units for ice control; result of experiments at Waddington, N.Y., where 1,000,000 tons of ice were moved; iceberg destruction.

INDICATORS

HIGH-SPEED. Some Uses of the High-Speed Multi-Cylinder Indicator, H. M. Jacklin. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 543-546, 8 figs. Particulars of simple, rugged device for use on high-speed internal-combustion engines and air compressors; diagrams obtained; multi-unit development for obtaining diagrams simultaneously from all cylinders of engine or compressor.

MAIHAK. Indicating H.p. Without the Planimeter, D. McKay. Motorship, vol. 12, no. 5, May 1927, pp. 390-392, 3 figs. Use of integrator instead of ordinary indicator saves labour of planimetering cards.

INDUSTRIAL MANAGEMENT

INVENTORY CONTROL. More Business on Less Inventory, W. W. Smith. Factory, vol. 38, no. 5, May 1927, pp. 874-875, 3 figs. Describes methods of Smith Bros., manufacturers of cough drops; close but simple control of inventories of both raw material and finished products.

MOTION-TIME ANALYSIS. Labour Costs at the Lowest Figure, A. B. Segur. Mfg. Industries, vol. 8, no. 4, Apr. 1, 1927, pp. 271-274. Gives seven steps in motion-time analysis, which are applicable to any kind of manufacturing, for they apply to all physical work.

LABOUR-TIME REDUCTION. Reducing Labour Cost, L. A. Sylvester. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 353-358, 2 figs. Labour-time depends upon way in which work is done, upon working conditions and upon degree of skill of worker; author's methods will help manufacturer to lower his labour costs by reducing his labour-time and by getting most favourable combination of operations, conditions and skill.

PRODUCTION CONTROL. Equalizing Production in Spite of Seasonal Demand, G. H. Townsend. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 341-344, 6 figs. Production programme in Moto-Meter Co. has been so arranged that fairly uniform schedule of manufacturing is maintained, despite sales fluctuations caused by varying demand from consumers for instruments; general policy found most economical is to accumulate stock during slow-sales season and let it gradually be reduced as greater demand develops during busy season.

PURCHASING. Fixing Least-Cost Purchase Quantities, R. C. Davis. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 369-372, 2 figs. Finding minimum ordering point.

Saving Through the Purchase Budget, W. N. Mitchess. Mfg. Industries, vol. 8, no. 4, Apr. 1927, pp. 283-286, 3 figs. Adjusting purchases to variable needs of business. Abstracted from author's forthcoming book on purchasing.

TIME STUDY. *See Time Study.*

INDUSTRIAL PLANTS

LOCATION. Labour Consideration in Plant Location, H. S. Colburn. Mfg. Industries, vol. 8, no. 4, Apr. 1927, pp. 261-264. Labour supply and quality taken together not only constitute major factor in selection or retention of a site for industrial plant, but often are of transcendent importance in manufacturing success.

PURCHASED VS. GENERATED POWER. Reducing Cost of Generated Power, A. F. Sheehan. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 365-366. Question of buying or generating power is not usually settled by any single comparison of kw-hr. costs; presents for typical cases: (1) two parallel situations requiring opposite answers; (2) substitute plan which changed possible per cent return into 54 per cent return; (3) $7,000 investment replacing $50,000 proposal, with yield of 183 per cent annually; and (4) dollar-down contract involving $25,000 engine installation, rest paid from savings totalling $21,000 yearly.

INDUSTRIAL TRUCKS

GASOLINE. The Varied Industrial Uses of Gasoline Tractors and Trucks, N. A. H. Mugruer. Factory, vol. 38, no. 5, May 1927, pp. 866-870, 998 and 1002, 25 figs. Pictorial analysis of types and applications; major types are (1) strictly load-carrying trucks; (2) 10 w-lift trucks; (3) combined load-carrying and load-pulling trucks; (4) strictly load-pulling tractors; (5) crane tractors, and (6) crawler-tread caterpillar tractors.

LIFT. How to Get the Most from Lift Trucks, W. C. Stuebing. Mfg. Industries, vol. 8. no. 4. Apr. 1927, pp. 253-256, 3 figs. Points out vast economies which they offer in manufacturing and transportation.

LIFT, SKIDS FOR. Skids for Use with Lift Trucks as Factors in Reducing Materials Handling Costs, F. L. Eidmann. Indus. Mgmt. (N.Y.), vol. 73, no. 5, May 1927, pp. 283-289, 22 figs. Explains how idea of using skids was first conceived and outlines how use of these materials-handling devices led to later development of hand lift truck; different types of skids.

INSPECTION

MANUFACTURED ARTICLES. Reducing Spoilage Losses, P. F. Copper. Mfg. Industries, vol. 13, no. 5, May 1927, pp. 359-360. 1 fig. New solution for difficult problem in inspection control of manufactured articles.

INSULATION, HEAT

CELOTEX. The Manufacture and Uses of Celotex Insulating Materials. C. G. Muench. La. Eng. Soc.—Proc., vol. 7, no. 6, Dec. 1926, pp. 198-225 and (discussion) 225-230. Fundamental principles of manufacturing; process has been worked out so that it is comparatively simple and easily controlled, it is made from bagasse; advantages of that it does not flame readily, contains no pitch or rosin, retards passage of heat of fire to combustible material beyond, etc.

LOW THERMAL CONDUCTIVITY MATERIALS. Some Materials of Low Thermal Conductivity, E. Griffiths. Refrig. Eng., vol. 13, no. 9, Mar. 1927, pp. 283-286. Thermal conductivity of following materials has been determined: expanded rubber (soft and hard), Balsa wood, Kingia Australis fibres, "eel grass" mat, compressed peat, and peat treated with bituminous materials.

INTERNAL-COMBUSTION ENGINES

FUEL ECONOMY. Fuel Waste. Motor Transport, vol. 44, no. 1154, Apr. 25, 1927, pp. 489-490, 2 figs. Problem of ensuring fuel economy in internal-combustion engines at all speeds and loads.

See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines; Semi-Diesel Engines.

IRON AND STEEL

LOCOMOTIVE. Metallurgy of Locomotive Iron and Steel, F. Williams. Ry. Mech. Engr., vol. 101, no. 5, May 1927, pp. 264-268, 18 figs. With reference to heat treating and physical properties desirable for locomotive use; character of alloy steels; characteristics of spring steel.

IRON CASTINGS

BLAST-FURNACE. Blast-Furnace Metal Castings. Foundry Trade Jl., vol. 35, no. 557, Apr. 21, 1927, pp. 343-344. It may be considered that use of direct blast-furnace metal was very earliest method adopted of supplying molten metal to iron foundry; exclusion from British specifications; extensive foreign employment; traditional prejudice; direct metal and sulphur content; other grounds of objection to use of direct metal; incorporation of receiver desirable.

BLOWHOLES. The Problem of Blowholes. Iron & Steel Industry & Brit. Foundryman, vol. 1, no. 1, Apr. 1, 1927, pp. 16-17. Simple explanation of their cause and suggestions for minimizing their injurious effect.

PHYSICAL VS. CHEMICAL ANALYSIS. Mechanical Methods Make or Mar Castings, E. G. Brock. Can. Foundryman, vol. 18, no. 4, Apr. 1927, pp. 14-15. While chemical analysis is of great value in producing castings free from shrinkage and hard spots, many foundrymen accomplish, without its aid, results which others by shrewd manipulation of elements, fail to achieve; hard castings; shrinkage and risers.

SNAGGING. Notes on Snagging. Iron & Steel of Canada, vol. 10, no. 4, Apr. 1927, pp. 107-109, 4 figs. Snagging generally means rapid removal of large quantities of metal from rough castings as they come from moulds; it is process which, because of its high production and efficiency, has practically eliminated chipping as standard method for cleaning castings; large quantities of wheels are used, and for this reason factors affecting choice and use of wheels should be clearly understood.

IRON FOUNDING

SOIL PIPE AND FITTINGS. Making Soil Pipe and Fittings, E. G. Brock. Can. Foundryman, vol. 18, no. 4, Apr. 1927, pp. 7-9, 4 figs. Efficiency in production of pipe and fittings is achieved in plant of Toronto Hardware Co. by simplification of operations, and utilization of modern equipment; little-used method of slagging cupola adopted.

IRRIGATION

FINANCE. Some Phases of Irrigation Finance, D. C. Henny. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 896-912. Increase of irrigated area will and should be slow when and where crop prices do not render farming profitable; private enterprise will continue to bring about healthy irrigation expansion on small scale in many localities as soon as crop prices become generally profitable; irrigation districts will continue to play large part in financing of improvements of existing projects and, to some extent, in construction of small new projects under especially favoured conditions; irrigation district method is not well adapted to reclamation of large areas of desert land.

L

LATHES

COPY-TURNING ATTACHMENT. Turret Lathe Copy-Turning Attachment. Machy. (Lond.), vol. 30, no. 757, Apr. 14, 1927, pp. 57-58, 3 figs. Turning attachment of simple construction for use on turret lathes in connection with production of turned pieces.

LEAD ORES

ONTARIO. Lead-Zinc Ore Near Searchmont Station, T. L. Gledhill. Can. Min. Jl., vol. 48, no. 16, Apr. 22, 1927, p. 325. Lead-zinc ore showing some promise has been found in west central part of Township 23, Range X, District of Algoma.

LOCOMOTIVES

CINDER PLANTS. Mechanical Cinder Plant Serves Several Tracks. Ry. Age, vol. 82, no. 21, Apr. 23, 1927, pp. 1243-1244, 4 figs. Moderate first cost and economy in use of track space are two of primary advantages claimed for new type of cinder-handling plant installed on number of roads.

CYLINDER LUBRICATING VALVE. Constant-Lubrication Valve for Superheated Steam Locomotive Cylinders. Engineering, vol. 123, no. 3 95, Apr. 8, 1927, p. 418, 2 figs. In order to prevent trouble from steam getting into supply pipes and to condensing, valves have been introduced into pipes near delivery points, reliance being placed on pressure being maintained in lubricating system sufficiently high to overcome that in steam chest and cylinders and prevent oil being fed to these parts; German firm made study of these problems, by fitting glass tubes and pressure gauges at various points in pipes of lubricating system and also near cylinders on locomotives in order to make observation on piston valves.

DIESEL-GEARED. Diesel Locomotive with Gear Transmission, A. I. Lipetz. Ry. Mech. Engr., vol. 101, no. 5, May 1927, pp. 270-275, 7 figs. Diesel-electric locomotive built in Esslingen, Germany, was tested on specially built locomotive testing plant; results of tests and conclusions drawn by Dobrovolsky; concludes that Diesel-geared locomotive is lightest Diesel locomotive in existence; advantage of fuel economy resulting from high thermal efficiency of Diesel-geared locomotive which attains figure of 29.3 per cent; after tests were completed Dobrovolsky locomotive was sent to Russia under its own power.

EUROPEAN DEVELOPMENTS. Recent European Motive Power Developments, C. B. Page. West. Soc. Engrs.—Jl., vol. 32, no. 3, Mar. 1927, pp. 77-91 and (discussion) 91-94, 7 figs. It is generally conceded that practical limit in size and weight of piston-type locomotives is about reached, but thermal efficiency is low when compared with other power-producing machines; condensed statement of number of important developments during past year in Europe, where rapid progress has been made; of these, use of high steam prssures, preheated furnace air and condensing-turbine locomotives seem most interesting; efficiencies more than double best in American practice are obtained.

FRAME-BED CASTINGS. Improved Locomotive Frame Bed. Ry. & Locomotive Eng., vol. 11, no. 4, Apr. 1927, pp. 103-105, 3 figs. Mountain-type locomotive of Southern Pacific Railway having one-piece cast-steel locomotive bed; cast steel used contains 18 per cent carbon and 73 per cent manganese; time required to pour steel into mould for one complete engine bed was about 11 minutes; steel was poured through special nozzle from ladle containing 50 tons of molten steel.

INTERNAL-COMBUSTION. Tractive Effort of Internal-Combustion Locomotives. Ry. Engr., vol. 48, no. 568, May 1927, pp. 182-183. Question as to whether of two-stroke or four-stroke cycle, and also whether of single- or double-acting type, is important, since it determines number of power impulses per revolution and also value of mean effective pressure.

SWITCHING. Six-Wheel Switchers for the Seaboard Air Line. Ry. Mech. Engr., vol. 101, no. 5, May 1927, pp. 266-268, 2 figs. Also Ry. & Loco. Eng., vol. 11, no. 4, Apr. 1927, pp. 113-114, 1 fig. Maximum tractive force of 45,000 lb. with 65 per cent limited cut-off; total weight, 180,000 lb.

LUBRICATING OILS

TESTS. Lubricating Oils; Laboratory Tests in Relation to Practical Results. A. G. Marshall and C. H. Barton. Engineering, vol. 123, no. 3195, Apr. 8, 1927, pp. 435-439, 7 figs. It has been shown by research into practical meaning of common laboratory tests for lubricating oils: (1) That there is no substantial benefit to be derived from compounding oil to improve "oiliness"; (2) although formation of decomposition products in service is undoubtedly important factor in lubricating-oil quality, laboratory tests at present applied do not evaluate that factor correctly; (3) no justification is apparent for judging of oil by viscosity changes above 70 deg.

LUMBER

HANDLING. Material Handling Between Stump and Board, L. C. Bell. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 503-516, 14 figs. Processes employed in Appalachian Mountain hardwood section; logging railroads; felling trees; "Ballhooting"; skidding; loading log trains; log pounds; handling in mill; piling and stacking; loading lumber on cars, etc.

LUMBER INDUSTRY

PACIFIC NORTHWEST. The Logging and Lumbering Interests of the Pacific Northwest. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 819-895, 31 figs. Symposium of following contributions: The Engineer in the Lumber Industry, J. J. Donovan: Logging Railroads, W. J. Ryan; Skyline Methods Used for Logging, K. Berger; Logging Flumes, U. B. Hough; Logging Inclines, H. G. Cowling; Ocean Log Rafts, W. T. Evenson; The Engineering Aspects of Saw-Mill Construction and Operation, B. L. Grondal; Electrification of Logging and Mill Equipment, O. D. Beach; Economic Aspects of Reforestation, E. T. Allen; Reforestation, J. B. Woods.

M

MACHINE TOOLS

AXLE-BOX MACHINING. Machining Axle Boxes. Brit. Machine Tool Eng., vol. 4, no. 44, Mar.-Apr. 1927, pp. 561-564, 6 figs. To perform boring, facing and radius operations on axle boxes for railway work, Richards & Co. have supplied machine specially constructed with its own crane to facilitate handling of axle boxes, and to avoid delay so often attendant upon use of shop cranes installed for general use.

DEVELOPMENTS. Recent Developments in Machine Tools, G. E. Bailey and T. Smith. Mech. World, vol. 81, nos. 2096, 2099, 2101 and 2102, Mar. 4, 11, 25, Apr. 8 and 15, 1927, pp. 165-166, 201, 217-218, 254-255 and 271-272, 13 figs.

VERTICAL VS. HORIZONTAL CUTTING. Selection of Machine Tools. Times Trade & Eng. Supp., vol. 20, no. 459, Apr. 23, 1927, p. 134. Important matter in connection with purchase of machine tools, and still more their employment, is whether action of cutting shall occur in vertical or horizontal direction; deals with turning, drilling, grinding, milling and gear cutting.

MAGNETIC FIELDS

GRAPHICAL DETERMINATION. Graphical Determination of Magnetic Fields, R. W. Wieseman. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 5, May 1927, pp. 430-437, 19 figs. Practical applications to salient-pole synchronous-machine design.

MANGANESE STEEL

WELDING. To Weld Manganese Steel. Iron & Steel of Canada, vol. 10, no. 4, Apr. 1927, p. 115. Preheating and heat treatment after welding are necessary for work on this metal.

MALLEABLE CASTINGS

MANUFACTURE. Some Experience with Malleable Cast Iron, H. Field. Foundry Trade Jl., vol. 35, nos. 553, 554 and 555, Mar. 24, 31 and Apr. 7, 1927, pp. 249-252, 271-274 and 291-292, including discussion, 22 figs. Mar. 24: Notes on number of interesting points which have arisen from time to time; as far as possible, practice rather than theory is dealt with; melting conditions; size limitations; jolt filling of annealing cans; types of ore used. Mar. 31: Annealing pots; nickel-chrome cans; specifications. Apr. 7: Conclusion and discussion.

MATERIALS HANDLING

EQUIPMENT. Solving the Materials Handling Problem, S. S. Moore. Can. Machy., vol. 37, no. 15, Apr. 14, 1927, pp. 26-30, 5 figs. Explains how each department of Richards-Wilcox plant at London, Ont., is served by time- and labour-saving materials-handling equipment in order that production processes may be facilitated.

The Progenitors of Modern Handling Devices, G. F. Zimmer. Indus. Mgmt. (N.Y.), vol. 73, nos. 2, 4 and 5, Feb., Apr. and May 1927, pp. 74-78, 242-245 and 308-311, 20 figs. Shows that present-day developments may be traced back to use centuries before Christian era. Feb.: Chinese chain pump and chain of pots are first types of conveyors known. Apr.: Evolution of gravity bucket conveyors, band conveyors and steam jet conveyors. May: Evolution of cranes, rope haulage and skip hoist.

Fixed Equipment. Fixed Equipment Speeds Production, W. T. Spivey. Can. Machy., vol. 37, no. 15, Apr. 14, 1927, pp. 21-23, 3 figs. Outlines progress being made in materials handling by fixed equipment, with particular emphasis on increasing application of standardized machines and methods to special problems of industry.

New York Port. Material Handling in the Port of New York, J. A. Jackson. Mech. Eng., vol. 49, no. 5, May 1927, pp. 411-413. Introduction of mechanical-handling devices hitherto retarded by design of existing structures, present methods of stevedoring and installation not economically justifiable; methods being used in handling bulk freight; mechanical-handling methods used for package freight.

METAL WORKING

Equipment. Forty-four Per Cent of All Metal Working Equipment is at Least Ten Years Old, W. E. Irish. Am. Mach., vol. 66, no. 19, May 12, 1927, pp. 759-764. Summary analyzes types of machines by per cent of total in use in sixteen combined divisions; provides counts of old equipment by divisions and shows total of approximately 414,000 machines that have seen ten years or more of active service in divisions studied.

Machine Shops and Foundries. Largest Group of Users of Metal Working Machinery. Am. Mach., vol. 66, no. 18, May 5, 1927, pp. 731-732, 2 figs. Manufacturers of machine shop and foundry products and equipment use many more metal working machines than any other division in metal working field.

Screw Machines. Press Work a Factor in Production on Screw Machines. Am. Mach., vol. 66, no. 16, Apr. 21, 1927, pp. 647-648. Presents table of metal working machine in screw machine products plants.

METALS

Creep. Some Observations on the Creep of Metals, D. Hanson. Metallurgist (Supp. to Engineer), Apr. 20, 1927, pp. 54-56. Refers to paper by R. W. Bailey read before Inst. of Metals in March 1926 on mechanism of creep; preliminary results of present author's research into creep of metals, carried out with view to ascertaining effect of creep on properties of material; material selected was pure aluminum sheet; most important observation is considerable degree of strain hardening which occurred in method during process of creep.

Non-Ferrous. *See Non-Ferrous Metals.*

METERS

Test Board. New Meter Board Facilitates Tests, E. A. Corum. Elec. World, vol. 89, no. 16, Apr. 16, 1927, pp. 814-815, 2 figs. Demand-meter test board that permits conducting time and life tests on almost any kind of integrating, recording meter of instrument having either spring or electric drive, designed by Memphis Power & Light Company.

MILLING MACHINES

Twin Overarms. Double Overarms and Cutting Efficiency. Brit. Machine Tool Eng., vol. 4, no. 44, Mar.-Apr. 1927, pp. 570-573, 6 figs. Tests of two machines with single and double overarms respectively; shows increase in cutting efficiency of milling machines obtained by use of twin overarms.

MINERAL INDUSTRY

Canada. Preliminary Report of the Mineral Production of Canada During the Calendar Year 1926. Canada Dominion Bur. of Statistics—Preliminary Report, Mar. 14, 1927, 51 pp. Industry showed continued progress throughout 1926; notable advances appeared in figures for copper, gold, precious metals, silver, lead and zinc among metals, and for coal, feldspar, gypsum, graphite, natural gas, petroleum, pyrites, quartz and salt among non-metals.

MINES

Electrical Equipment. Much Electrical Equipment Tested for Safety by U.S. Bureau of Mines, L. C. Ilsley. Coal Age, vol. 31, no. 17, Apr. 28, 1927, pp. 598-601, 3 figs. Work of bureau is of advisory, not mandatory, nature; power truck offers much in way of safety; co-operation sought, but not demanded.

MOULDING METHODS

Sand Moulding. Sand Moulding Practice, J. D. Nicholson. Foundry Trade Jl., vol. 35, no. 557, Apr. 21, 1927, pp. 339-342, 13 figs. Deals with essential moulding principles it is necessary to perform correctly and ill effects produced if they are not followed; ramming; venting; dried moulds; runners.

MOULDS

Water-Cooled. Water-Cooled Moulds. Metallurgist (Supp. to Engineer), Apr. 20, 1927, pp. 56-58, 5 figs. Two important factors influencing quality of ingots are behaviour of mould and process of solidification; refers to work by Junker in Zeit. für Metallkunde, Oct. 1926, with special reference to brass casting; important field of application for water-cooled mould lies in casting of large aluminum alloy ingots.

MOTOR BUSES

Design. The Design of Motor Buses (Aménagement technique de l'autobus), M. Chauchat. Industries des Voies Ferrées et des Transports Automobiles. vol. 21, no. 243, Mar. 1927, pp. 157-166, 5 figs. Notes on chassis, transmission, engine, cooling, carburetors, fuels, lubrication, bearings, suspension, wheels, tires, etc.

Gasoline-Electric. The Gasoline-Electric as a Transportation Unit. Bus Transportation, vol. 6, no. 5, May 1927, pp. 251-253, 3 figs. After two years' use by Capitol District Transportation Co. serving Albany, Troy, etc., of electric drive, main advantages are said to be (1) general indorsement by public; (2) easier work for drivers, and (3) faster schedules on difficult hillside routes.

Urban and Interurban. Urban and Interurban Buses, B. I. Budd. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 813-818. In city service motor coach has its greatest economic value when operated in conjunction with electric railways; in suburban and interurban fields it is most useful for comparatively short hauls of 20 miles or less; cost of operating motor coach service is greater than that of rail service and is always likely to be so; railway operators, with their special training and experience, are best qualified to operate motor coaches and co-ordinate them with railways.

MOTOR TRUCK TRANSPORTATION

Merchandizing. Merchandizing Motor Truck Transportation, C. S. Lyon. Soc. Automotive Engrs.—Jl., vol. 20, no. 5, May 1927, pp. 582-586 and (discussion) 586-588, 4 figs. Details of garage and shop facilities and automotive equipment of haulage company with which author is connected; economical location, construction and arrangement of garage is important feature; use of dynamometer for testing overhauled engines. Discussion of paper centres mainly around advantages of use of dynamometer and triple tires; cost and possible economy of duralumin body; effect on maintenance cost of overloading vehicles 100 per cent, and probable effect on profits at present haulage rates.

N

NICKEL

Uses. Practical Uses of Pure Nickel, R. J. McKay. Am. Electrochem. Soc.—Advance Paper, no. 47, for mtg. Apr. 28-30, 1927, pp. 457-461. Chemically pure nickel does not show any marked differences in properties from present grades of high purity; applications of very pure commercial nickel; sulphur-free nickel is now commercial product.

NICKEL STEEL

Instability. The Cause of Instability of Nickel Steel (La cause de l'instabilité des aciers au nickel), C. E. Guillaume. Archives des Sciences Physiques et Naturelles, vol. 9, no. 5, Jan.-Feb. 1927, pp. 5-15, 5 figs. Criterion of instability; action of carbon, manganese, copper and chromium; shows that in order to stabilize nickel steel it is necessary to hinder formation of cementite by combining carbon with substance to which it has stronger affinity than iron, such as tungsten and vanadium.

NON-FERROUS ALLOYS

Segregation. The Mechanism of Inverse Segregation in Alloys, R. Genders. Engineering, vol. 123, no. 3193, Mar. 25, 1927, pp. 370-372 and 405-406, 14 figs. Deals chiefly with non-ferrous alloys which are usually cast in moulds smaller than those used for steel and which solidify with relatively greater rapidity; common type of heterogeneity is segregation outwards of lower melting constituent of alloy, in contradiction of results which would be predicted by equilibrium diagram; phenomenon has been termed inverse segregation or liquation; reviews present theories and suggests directions in which data essential for completion of general theory must be sought. Paper read before Inst. of Metals.

NON-FERROUS METALS

Corrosion. The Atmospheric Corrosion of Metals. Engineer, vol. 143, no. 3717, Apr. 8, 1927, pp. 374-376. Review of second experimental report to Atmospheric Corrosion Research Committee of Brit. Non-Ferrous Metals Research Assn.; deals with indoor and open-air exposure tests, former including associated laboratory experiments.

Molten Solder, Attack of. The Attack of Molten Metals on Certain Non-Ferrous Metals and Alloys, H. J. Hartley. Engineering, vol. 123, no. 3194, Apr. 1, 1927, pp. 399-403, 16 figs. Metallographic examination of unstressed brasses attacked by molten tin at 300 deg. cent.; tensile tests on materials under tin and solder attack; experiments on copper and brass wire; concludes that tin content of solder seems of greatest importance in determining its attacking power. Paper read before Inst. of Metals.

O

OIL ENGINES

Energy Diagram. A Characteristic Energy Diagram for an Oil Engine and the Marine Oil Engine Trials, W. E. Dalby. Shipbldg. & Shipg. Rec., vol. 29, no. 15, Apr. 14, 1927, pp. 424-431 and (discussion) 449-450, 7 figs. Exposition of principles on which diagram is based; shows application of diagram to data given in tables in several reports of the committee; comparison of results. Abstract of paper read at Instn. Nav. Architects. See also Engineer, vol. 143, no. 3718, Apr. 15, 1927, pp. 420-422, 9 figs; also Engineering, vol. 123. nos. 3195 and 3196, Apr. 8 and 15, 1927, pp. 414-417 and 467-469, 11 figs.

European Practice. Speed and Weight, Issues in Oil Engine Design, F. Johnstone-Taylor. Power Plant Eng., vol. 31, no. 9, May 1, 1927, pp. 514-516, 4 figs. Recent European designs show trend toward increased speeds and decreased weights in oil-engine practice.

Foundations. The Construction of Oil Engine Foundations, V. L. Maleev. Oil Engine Power, vol. 5, nos. 3, 4 and 5, Mar., Apr. and May 1927, pp. 175-180, 247-249 and 325-327, 33 figs. Exhaustive data on sizes, weights, materials of concrete and masonry foundations.

Ice Plants. Increasing Profits by Oil Engine Drive, E. J. Kates. Power House, vol. 21, no. 8, Apr. 20, 1927, pp. 27-30. Author shows form analysis of costs that under certain conditions oil engine is more economical and reliable than any other source of power for manufacture of ice.

Operation. Averting Trouble in Oil Engine Operation. Power House, vol. 21, no. 8, Apr. 20, 1927, pp. 33-35, 2 figs. Valuable hints are given on operation of oil engines, prevention of trouble, methods of detecting and overcoming it when it does develop, and effect on power costs.

Solid-Injection. Large Oil Engine on Production Basis. Oil Engine Power, vol. 5, no. 5, May 1927, pp. 302-305, 5 figs. One of largest types of 4-cycle, solid-injection engines designed and built in United States in shops of DeLaVergne Machine Co.

OIL FUEL

Burners. Oil Burners for House Heating. Sibley Jl., vol. 41, no. 4, Apr. 1927, pp. 118-120 and 132. Types of burners; combustion; selecting burners; cost of heating with coal and oil.

World's Future Supply. The World's Future Supplies of Liquid Fuels, J. B. C. Kershaw. Engineer, vol. 143, nos. 3712, 3713, 3714, 3715 and 3716, Mar. 4, 11, 18, 25 and Apr. 1, 1927, pp. 244-245, 261-263, 292-294, 316-317 and 344-345, 3 figs.

OPEN-HEARTH FURNACES

100-Ton. The Design of 100-Ton Open-Hearth Furnaces (Dimensions des fours Martin de 100 tonnes), A. Pavloff. Revue de Métallurgie, vol. 24, no. 1, Jan. 1927, pp. 1-9. Results of author's investigations and calculations; dimensioning of hearth surface; gas and air burners; recuperators; valves, flues and stack. Translated from Russian.

Recuperators. Recuperators Applied to Open-Hearth Furnaces, W. H. Fitch. Engrs'. Soc. West. Pa.—Proc., vol. 42, no. 10, Jan. 1927, pp. 506-517 and (discussion) 517-530, 7 figs.

OXY-ACETYLENE WELDING

Aluminum Sheet. Welding Pure Aluminum Sheet. Oxy-Acetylene Tips, vol. 5, no. 10, May 1927, pp. 188-191, 10 figs. Wide use of this material furnishes opportunities for fabricating special equipment.

APPLICATIONS. A Résumé of the Fields of Application of Oxy-Acetylene Welding and Cutting, D. S. Lloyd. Iron & Steel of Canada, vol. 10, no. 4, Apr. 1927, pp. 102-106, 11 figs. Describes only those applications of process that have been very successful in reducing costs in commercial field.

LOCOMOTIVE SIDE RODS. Cutting Side Rods with Acetylene Torch, F. H. Williams. Can. Machy., vol. 18, no. 16, Apr. 21, 1927, pp. 22-23, 7 figs. Shows results, good and bad, of cutting steel side rods of locomotives by this method, such rods being medium steel forgings, with carbon running from .25 to .55 per cent, but not higher carbon or alloy steels.

PLATE. Welding Plate of Medium Thickness. Acetylene Jl., vol. 28, no. 11, May 1927, pp. 521-524, 9 figs. Exercises suggested for training new welders in fundamental principles of welding materials used in fabrication of thin-walled tanks, extracted from book by R. Granjon, P. Rosenberg and A. Desgranges, of Paris.

STORAGE TANKS. Oxy-Acetylene-Welded Construction of a Large High-Pressure Storage Tank, H. E. Rockefeller. Mech. Eng., vol. 49, no. 5, May 1927, pp. 405-411, 20 figs. Design of tank; selection of material; checking of welders; welding longitudinal and girth seams; design of new manhole reinforcing ring and its welding to manhead.

TORCH MANIPULATION. Proper Use of Welding Torch, E. Louden. Brass World, vol. 23, no. 4, Apr. 1927, pp. 1'3-114, 4 figs. Hints about its manipulation and care; preheating for welding brass, aluminum and sheet metal; qualifications of welder.

P

PIERS

VANCOUVER, B.C. Construction of Pier B-C, Vancouver, A. D. Wilder. Can. Engr., vol. 52, no. 16, Apr. 19, 1927, pp. 437-441, 5 figs. Improved facilities for Canadian Pacific Railway to handle increasing trade with Orient; pier is 1,100 ft. long and 331 ft. wide; mixing and pouring plant for precast concrete piles; approximately 6,000 piles used.

PILES

SHEET. Steel Sheetpiling Used in Repair of Bridge Approaches. Eng. News-Rec., vol. 98, no. 17, Apr. 28, 1927, pp. 695-696, 4 figs. Heavy sections form walls of sand-filled coffers strengthened by tie-rods and channels; Florida structure.

PIPE

FLANGES. The Strength of Pipe Flanges, E. O. Waters and J. H. Taylor. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 531-542, 29 figs. Approximate methods of determining strength; proposed formulas for strength and deflection of rings; recommended proportions of flat rings; proposed method for determining strength and deflection of hubbed flanges; tests on hubbed flanges; recommended proportions of hubbed flanges.

PIPE, CAST-IRON

BRONZE WELDED. Temperature and Bending Strains in Bronze Welded C. I. Pipe Lines, E. Hering, F. G. Outcalt and T. W. Greene. Gas Age-Rec., vol. 59, no. 19, May 7, 1927, pp. 659-660, 3 figs. Necessity of careful laying procedure and desirability of expansion joints at 100-ft. intervals.

PIPE LINES

OIL. Locating Gravity Pipe Lines for Gathering Crude Oil, L. E. Davis. Eng. News-Rec., vol. 98, no. 18, May 5, 1927, pp. 728-729, 3 figs. Location; surveying methods.

POWER FACTOR

IMPROVEMENT. How to Improve the Power Factor of Electric Power Systems, C. G. Green. Nat. Engr., vol. 31, no. 5, May 1927, pp. 215-217, 4 figs. Practical suggestions on improving power factor of existing systems.

INDUCTANCE. Power Factor Simplified. Power, vol. 65, no. 19. May 10, 1927, pp. 701-703, 6 figs. What inductance is and its effects in electric circuits.

POWER TRANSMISSION

SHAFTING. Code for Design of Transmission Shafting. Mech. Eng., vol. 49, no. 5, May 1927, pp. 474-476. Covers: (1) designing formulas for cases most frequently met in design of transmission shafting; and (2) diagrams for use in designing shafting.

PRESSES

SAFETY CODE. Safety Code for Power Presses and Foot and Hand Presses. U.S. Bur. Labour Statistics—Bul., no. 430, Dec. 1926, pp. 1-62, 63 figs. Purpose of code is to provide reasonable safety for life, limb and health.

PRESSURE VESSELS

DESIGN. The Design and Construction of Pressure Vessels, L. J. Sforzini. Power, vol. 65, nos. 17 and 18, Apr. 26 and May 3, 1927, pp. 623-625 and 670-674, 11 figs. Fundamental principles; cast and riveted construction; modern practice in seamless and welded construction.

PRINTING MACHINERY

ELECTRIC DRIVE. Electricity in the Modern Newspaper Plant. H. C. Jorstad. Elec. Jl., vol. 24, no. 5. May 1927, pp. 194-198, 10 figs. Equipment of plant of Pittsburgh Press Publishing Co.; power comes into this plant at 4,000 volts, 3-phase, 60 cycles from lines of Duquesne Light Co.; mechanical processes; press-motor control.

PUMPS, CENTRIFUGAL

FIRE. Report of Committee on Fire Pumps. Nat. Fire Protection Assn.—Advance Paper, 1927, 6 pp. Water passages of centrifugal pumps; gasoline-engine driving of centrifugal pumps; electric driving and control of pumps.

R

RADIOTELEPHONY

INTERFERENCE. Location of Radio Interference, B. E. Ellsworth. Elec. World, vol. 89, no. 16. Apr. 16, 1927, pp. 810-811, 1 fig. Procedure followed in tracing source of trouble; equipment used; most frequent causes of trouble.

SIGNALS. A Comparison of the Variation of Intensity and Direction of Radio Signals, H. J. Reich. Franklin Inst.—Jl., vol. 203, no. 4, Apr. 1927, pp. 537-548, 9 figs. Results of these experiments; rapid and pronounced fading is usually accompanied by rapid direction changes of large amplitude throughout evening, but there seems to be no correlation as to exact time at which changes occur for two phenomena, or between amplitudes of fluctuations over short interval; two phenomena frequently begin and end almost simultaneously, but not always; there is no correlation between direction changes in signals from two different stations.

RAILS

CORRUGATION REMOVAL. The Treatment of Rail Corrugations. Tramway & Ry. World, vol. 61, no. 19, Apr. 14, 1927, p. 199, 1 fig. Essanee rail grinder was designed by practical tramway engineer to meet requirements of his own system.

JOINTS, WELDED. Committee on Welded Rail Joints—Progress Report No. 5—July 1926, Am. Welding Soc.—Jl., vol. 6, no. 3, Mar. 1927, pp. 12-72, 38 figs. Summary of tests and reports; shear tests. Report on Longitudinal Sharing Tests of Rail Plate Welds, R. J. Fogg; analysis of results of shear tests giving highest values; Comments of Shear Test Results, H. L. Whittemore; telemeter investigations; report on preliminary tests of welded rails, Baltimore, Aug. 2-3, 1926; programme of additional investigations proposed by Committee; suggested programme for strain gauge measurements of welded rail joints.

RAILWAY SIGNALLING

AUTOMATIC BLOCK. Committee IV—Direct Current Automatic Block Signalling. Am. Ry. Assn., Signal Sec.—Proc., vol. 24, no. 4, Apr. 1927, pp. 646-658. D.c. vibrator crossing bell; minimizing effect of lightning and foreign current on d.c. track circuits; prevention of sweating of relays.

Committee VIII—Alternating Current Automatic Block Signalling. Am. Ry. Assn., Signal Sec.—Proc., vol. 24, no. 4, Apr. 1927, pp. 726-731. Rectifiers for signal systems; protection from lightning.

COLOURED LIGHT SIGNALS. Visibility of Light Signals in Daylight (Die Sichtbarkeit von Lichtsignalen bei Tage), L. Bloch. Licht u. Lampe, no. 7, Apr. 7, 1927, pp. 239-242, 3 figs. Discusses problem of light signals in daylight which, in author's opinion, require further investigation; results of tests carried out by Osram Corp.; influence of shade of color on visibility.

POWER INTERLOCKING. Committee III—Power Interlocking. Am. Ry. Assn., Signal Sec.—Proc., vol. 24, no. 4, Apr. 1927, pp. 711-720. Automatic crossing protection at railway crossings.

RAILWAY TRACK

SURFACING. Surfacing Track with an End Tamping Trowel, C. R. Adsit. Ry. Eng. & Maintenance, vol. 23, no. 5, May 1927, pp. 201-202, 2 figs. How trowel is used.

RECTIFIERS

MERCURY ARC. Modern Power Mercury Arc Rectifiers, F. A. Farron. Elec. News, vol. 36, no. 9, May 1, 1927, pp. 37-38, 1 fig. Their development during recent years; advantages and disadvantages as compared to synchronous rotary converters.

RECLAMATION

STATE. State Reclamation in Washington, R. K. Tiffany. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 913-923. Conclusions as to proper functions of state with reference to reclamation; state is not justified in expending funds raised by tax on all property, including agricultural land and products, to increase agricultural area by reclamation; programme as far as it can be outlined should include: (1) comprehensive study of possibilities and needs of state for increased agricultural production by means of reclamation; (2) continued effort to improve state laws relating to reclamation; state should support national reclamation policy and programme based on sound, economic principles.

REFRACTORIES

CHECKER BRICK. The Use of Super-Refractories as Checker Brick in Gas Manufacture, H. J. Knollman. Am. Ceramic Soc.—Jl., vol. 10, no. 4, Apr. 1927, pp. 299-308.

METAL FURNACES. Refractory Materials for Metal Furnaces, W. J. May. Mech. World. vol. 81, no. 2101, Apr. 8, 1927, p. 253. For crucible and other furnaces melting up to, and including, cast iron, good fireclay bricks with fireclay jointing will be found sufficiently refractory and durable, as heat of less than 2,500 deg. Fahr. is needed, but over this it is desirable to have something better.

SPALLING. The Spalling of Refractory Materials, A. T. Green and A. J. Dale. Ceramic Soc.—Trans., vol. 25, part 4, 1925-1926, pp. 428-470, 3 figs. Reviews experimental data already put forward by numerous workers, in light of recent experimental work by present authors; analyzes entire problem with object of deriving indications of special importance from structural, manufacturing and testing viewpoints. Bibliography.

STEEL FURNACES. Corrosion of Steel Furnace Refractories, A. Scott. Ceramic Soc.—Trans., vol. 25, part 4, 1925-1926, pp. 339-351, 2 figs. Describes normal types of corrosion.

THERMAL PROPERTIES. The Thermal Properties of Refractory Materials and a Consideration of the Factors Influencing Them. A. T. Green. Ceramic Soc.—Trans., vol. 25, part 4, 1925-1926, pp. 361-385, 7 figs. Specific heat of refractory materials; heat capacity per unit volume; temperature diffusivity; thermal conductivity and emissivity of firebrick surfaces. Bibliography.

REFRIGERATION

GAS. Refrigeration by Gas, J. A. Whittington. West. Soc. Engrs.—Jl., vol. 32, no. 3, Mar. 1927, pp. 107-114, 2 figs. Enumerates principal methods of refrigeration with short description of each and gives details of typical system utilizing cycle in which refrigerating action is made possible by use of heat.

HOUSEHOLD. Household Refrigeration, A. Philipp and C. C. Spreen. Refrig. Eng., vol. 13, no. 10, Apr. 1927, pp. 301-305 and (discussion) 306-309, 8 figs. Standard tests for household refrigerating compressors.

REINFORCED CONCRETE

STEEL ENCASED IN OLD CONCRETE. Condition of Steel Encased in Old Concrete, C. C. Everhart. Concrete, vol. 30, no. 5, May 1927, p. 20. Observations on physical condition of iron and steel after being encased in concrete for long period of time.

RESERVOIRS

COVERED. The Cleveland Reservoir, E. Peets. Am. Water Works' Assn.—Jl., vol. 17, no. 4, Apr. 1927, pp. 417-419. Drinking water is stored in covered reservoir known as Baldwin reservoir.

RIVERS

POWER RESOURCES. Tentative Standards for Rating Power Resources of Rivers Adopted. Eng. News-Rec., vol. 98, no. 17, Apr. 28, 1927, pp. 684-685. Rules formulated by committee appointed by American Engineering Standards Committee.

RIVETS

SPLIT AND TUBULAR. Split and Tubular Rivets. Soc. Automotive Engrs.—Jl., vol. 20. no. 5, May 1927. p. 558, 6 figs. Proposed dimensional specification for approval of S. A. E. recommended practice.

ROADS, CONCRETE

CONSTRUCTION. Comments on Concrete Road Construction, A. N. Johnson. Roads & Streets, vol. 67, no. 4, Apr. 1927, pp. 175-178, 1 fig. Recent developments in art of building concrete pavement. Paper presented at Annual Conference on Highway Engineering at Univ. of Michigan.

CRACK REGULATION. Experiments in Crack Regulation in Concrete Roads, C. E. Turnbull. Eng. News-Rec., vol. 98, no. 19, May 12, 1927, pp. 770-771, 1 fig. Crack survey of experimental pavements indicates that proportions of mix determine joint spacing required.

Cross-Joint Spacing. Theory of Spacing Cross-Joints in Concrete Roads, R. M. Green. Eng. News-Rec., vol. 98, no. 16, Apr. 21, 1927, pp. 641-642. Claims that it is unlikely that rational theory for spacing will ever be evolved which will be workable in all cases.

ROLLING MILLS

Merchant. The Rolling of Commercial Iron and Small Sections (Le laminage des fers marchands et des petits profiles), E. Poncelet. Revue de Métallurgie, vol. 24, no. 3, Mar. 1927, pp. 109-123, 26 figs. Describes methods and equipment; shearing machines; cooling beds; rolling of T-iron, angle, channel, flat and round iron, etc.

Rod and Wire. New Features are Incorporated in Tidewater Rod and Wire Mill, G. A. Richardson. Iron Trade Rev., vol. 80, no. 18, May 5, 1927, pp. 1151-1154, 6 figs. New mill placed in operation at Sparrows Point, Md., division of Bethlehem Steel Co.; rod mill is entirely gear-driven.

Steel Ingots. Rolls Steel Ingot Weighing 63,000 Lb. Iron Age, vol. 119, no. 19, May 12, 1927, pp. 1376-1377, 2 figs. Slabs 130 in. wide and 8¼ in. thick, for fabrication into gear-reduction unit flywheels, produced on 206-in. plate mill.

Welding and Cutting. The Maintenance of Rolling Mill Machinery. Oxy-Acetylene Tips, vol. 5, no. 10, May 1927, pp. 194-204, 22 figs. Breakdown delays are minimized when welding and cutting flames are freely used; wabbler repairs; welding aluminum bronze; pinion repairs.

ROLLS

Chilled. Chilled Roll Making. Foundry Trade Jl., vol. 35, nos. 555 and 557, Apr. 7 and 21, 1927, pp. 293-294 and 335-336. Apr. 7: Broader metallurgical aspects; current practice; nature of charge; furnaces; working charge; casting temperature. Apr. 21: Future prospects; factors affecting chill; economies to be effected; gas firing; pulverized fuel; suggested duplex process.

S

SAND MOULDING

Research. Recent Foundry Sand Research, T. C. Adams. Sibley Jl., vol. 41, no. 4, Apr. 1927, pp. 111-117, 130 and 136, 8 figs. Review of research being conducted under direction of American Foundrymen's Assn., including study properties of sand; testing methods and apparatus; permeability and strength tests.

Strength. The Strength of Moulding Sands, J. G. A. Skerl. Brit. Cast Iron Research Assn.—Bul., no. 16, Apr. 1927, pp. 10-13. Deals briefly with this subject, as well as relation of strength to other properties of moulding sands, and also to its treatment in foundry.

SAW MILLS

Design. Problems of Wood-Working. Eng. Progress, vol. 8, no. 4, Apr. 1927, pp. 99-101, 7 figs. Two points are of greatest importance in layout of saw mills; first is to provide appropriate appliances for bringing along timber to be worked, and second consists in using machines possessing highest possible cutting velocities.

SAWS

Hot, Direct-Connected. Direct-Connected Hot Saws, N. D. Cooper. Iron & Steel Engr., vol. 4, no. 4, Apr. 1927, pp. 202-204, 2 figs. Eliminates use of belt with its inherent ills, and resulting compact and efficient units obtained indicates that future tendency will be to adopt this form of construction.

SEMI-DIESEL ENGINES

Applications. Application of the Semi-Diesel Oil Engine, E. W. Thompson. Can. Engr., vol. 52, no. 17, Apr. 26, 1927, pp. 457-459, 4 figs. Various purposes for which this type of engine has been successfully employed; principal characteristics; operating features; values of fuel oils; fuel-consumption tests.

SEWAGE

Chemical Oxidation. The Chemical Oxidation of the Constituents of Sewage: The Action of Hydrogen Peroxide, E. A. Cooper and W. H. Read. Chem. & Industry, vol. 46, no. 16, Apr. 22, 1927, pp. 156t-157t. Investigations directed to problem of discovering chemical oxidation test of short duration analogous to dissolved-oxygen absorption process, which has practical disadvantage of covering period of five days.

SEWAGE DISPOSAL

Sand Filters. Intermittent Sand Filters, E. Boyce. Iowa State College of Agriculture and Mechanic Arts—Off. Publications, vol. 25, no. 35, Jan. 26, 1927, pp. 3-7, 3 figs. Intermittent sand filters, while requiring considerable maintenance in order to prevent ponding, are capable of producing effluent that is well oxidized and has lower bacterial content than is obtained with coarser grained biological filters.

SEWERS

Outfall. Outfall Sewer Experiences in Imperial Valley, R. F. Goudey. Eng. News-Rec., vol. 98, no. 16, Apr. 21, 1927, pp. 648-649, 2 figs. Odor nuisance from manholes and Imhoff tanks and mortar disintegration controlled by keeping sewer full.

SHAFTS

Whirling Speeds. A Graphical Method for Determining the Whirling Speeds of Loaded Shafts, H. H. Jeffcott. Lond., Edinburgh and Dublin Philosophical Mag. & Jl. of Science (Supp. no.), vol. 3, no. 16, Apr. 1927, pp. 689-713, 4 figs. Account of graphical method by which whirling speeds of shafts may be approximately determined in simple and rapid manner; method is not to be confused with that by which deflection of loaded shaft may be determined graphically by use of bending-moment diagram.

SHEET METAL

Annealing. New System Flat-Pack Sheet-Annealing Process. Iron & Coal Trades Rev., vol. 114, no. 3085, Apr. 15, 1927, p. 606, 3 figs. It is claimed that with this system difficulties are eliminated, while it is possible with flat-pack, under satisfactory conditions of efficiency and minimum handling costs, to obtain heating surface as high as 30 sq. ft. per ton of sheets; main advantages claimed for system are summarized.

Rolling. Recent Developments in the Rolling of Sheet Metal. Mech. Eng., vol. 49, no. 5, May 1927, pp. 451-454, 2 figs. Particulars regarding process of rolling steel sheets; application of continuous principle to sheet rolling, and increased production and savings possible through its adoption.

SILICA BRICK

Open-Hearth Furnaces. The Alteration of Silica Bricks in Open-Hearth Furnaces, E. Sieurin. Ceramic Soc.—Trans., vol. 25, part 4, 1925-1926, pp. 400-406. In order to obtain direct comparison under works conditions, sample bricks were built into one of side walls of open-hearth furnace hearth at Swedish steel mill; these bricks were particularly well burnt; at same time bricks, also of superior quality of German manufacture, were placed in walls of same furnace hearth; tests made at Höganäs show that, although softening point of bricks is about same as that of standard silica brick, resistance to corrosion by slag decreases owing to admixture of considerable quantity of ferric oxide.

SPEED REDUCERS

Paper-Mill Types. Speed Reducers and Their Application. Paper Indus., vol. 9, no. 1, Apr. 1927, pp. 78-82, 19 figs. Types for pulp and paper mill requirements.

SPRINGS

Hairsprings for Instruments. The Manufacture and Properties of Hairsprings, H. Moore and S. Beckinsale. Engineering, vol. 123, no. 3195, Apr. 8, 1927, pp. 439-440. Investigation at Research Department, Woolwich, into manufacture and properties of several types of hairsprings for instruments; related work, mainly of metallurgical nature, has also been carried out on small springs used for other purposes.

Hysteresis of. Hysteresis Relative to the Operation of Mechanical Springs, J. K. Wood. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 561-569, 20 figs. Springs and spring systems are shown to be associated with physical hysteresis of three characteristic types, mechanical, hypo-elastic and hyper-elastic hysteresis; former is shown to be important from standpoint of automotive riding quality; mechanical hysteresis is caused by external agencies, while both hypo-elastic and hyper-elastic hysteresis are caused by internal behaviour of crystalline structures; hypo-elastic hysteresis is due to internal friction of solid type, while hyper-elastic hysteresis is due to slip or plastic flow and hence has characteristic time factor.

STEAM ENGINES

Metallic Packing. The Brit. Metallic Packing Engineering, vol. 128, no. 3194, Apr. 1, 1927, p. 403, 6 figs. on p. 402. Type of packing ring with which it is impossible to increase pressure on rod or shaft once it has been correctly adjusted and in which any want of alignment in moving parts is automatically provided for; manufactured by Brit. Metallic Packings Co.

Quadruple-Expansion. A New Type of Quadruple-Expansion Engine. Mar. Engr. & Motorship Bldr., vol. 50, no. 597, May 1927, pp. 174-177 and 191, 3 figs. Novel valve-gear arrangements adopted to simplify and shorten engine.

STEAM GENERATION

Electric. The Economic Production of Steam by Electricity, C. J. Wharton. Combustion, vol. 16, no. 5, May 1927, pp. 271-273. Shows that it is commercial and economic proposition, under certain circumstances, to generate steam by electricity; conditions required are very cheap current, all machinery in works electrically driven and yet quantity of live steam required for process purposes in mill or factory.

Low-Grade Fuel for. Discussion on the Utilization of Low-Grade Fuels for Steam Generation. Eng. & Boiler House Rev., vol. 40, nos. 9 and 10, Mar. and Apr. 1927, pp. 472-476 and 530-531. Discussion of paper read before Instn. of Fuel Economy Engrs. by W. F. Goodrich.

STEAM POWER PLANT

Heat Balances. Heat Balances in Industrial Plants, C. A. Kelsey. West. Soc. Engrs.—Jl., vol. 32, no. 3, Mar. 1927, pp. 95-106, 7 figs. Question of purchased power vs. private plant is complicated in case of industry using heat in its processes, by possibility of generating power as by-product; describes number of such cases and shows that heat balance may be obtained that will bring greatest economy; data presented give idea how to make study of such plant to determine what should be done.

Oil Refineries. Using the Same Steam Three Times. Power, vol. 65, no. 20, May 17, 1927, pp. 732-737, 7 figs. Steam generated at 250-lb. gauge is exhausted from impulse element of 1,000-kw. turbine generator unit at 125-lb. pressure, is used to drive pumps, and is returned at 2-lb. gauge pressure to low-pressure reaction element of turbine which exhausts to condenser; boilers are equipped with forced-draught chain grates, air preheaters and fin-tube side walls.

STEAM TURBINES

Blade Erosion. Tests on Erosion Caused by Jets, E. Honegger. Brown Boveri Rev., vol. 14, no. 4, Apr. 1927, pp. 95-104, 14 figs. Purely qualitative tests show that erosion increases rapidly with velocity; metals which resisted erosion at speed of 130 m. per sec. showed large holes after being tested at 200 and 225 m. per sec.; relation between resistance to erosion of rustless steel and heat treatment; comparison between rolled 5.0 per cent nickel steel and drawn rustless chrome steel clearly showed superiority of former; tests on cast iron of various qualities showed that this metal offered smaller resistance to erosion than steel; characteristic erosion curves; influence of size of drops; relation between erosion and velocity; erosion and mechanical strength.

STEEL

Aging. The Aging of Mild Steel. Metallurgist (Supp. to Engineer), Apr. 20, 1927, pp. 49-50. Definition of aging; while it is clear that recovery of wrought iron and mild steel from plastic overstrain is intricate phenomenon of great importance, immediate question is whether it is this phenomenon which is described as aging in literature; further question arises as to what is meant by describing mild steel as free from aging.

Alloy. *See Alloy Steels.*
Chrome-Nickel. *See Chrome-Nickel Steel.*
Chromium. *See Chromium Steel.*
Nickel. *See Nickel Steel.*

Temper Brittleness. Temper Brittleness of Steel (Discussion sur la fragilité de revenu). Revue de Métallurgie, vol. 24, no. 1, Jan. 1927, pp. 36-40. Discussion by A. Portevin and L. Brenet of article by L. Gillet and M. Ballay, published in same journal, vol. 23, Sept. and Oct. 1926; and reply by authors. See reference to original article in Eng. Index 1926, p. 713.

Copper Deposition. Protecting Steel with a Copper Film, W. S. Barrows. Can. Foundryman, vol. 18, no. 4, Apr. 1927, pp. 15-16. Successful prevention of carburization of steel by deposition of copper upon it depends very largely on production of non-porous coating of copper, moderately thick, firm, adherent and close-grained.

STEEL, HEAT TREATMENT OF

Rails. New Process for Heat Treatment of Steel Rails (Nouveauz traitements thermiques de l'acier à rails), Marcotte and Martineau. Revue de Métallurgie, vol. 24, nos. 1 and 2, Jan. and Feb. 1927, pp. 10-19 and 67-68, 16 figs. Details of process, invented by C. F. Sandberg, and employed in France at Hagondange works; principles of process and details of installation shows that two processes, very different from each other, can be satisfactorily applied to prolong life of rails: (1) sorbitic process, as applied at Hagondange, which gives rail a sorbitic texture; and (2) process in situ, applied to street car rails on track, which gives superficial martensite layer which greatly increases life of rail.

Shop Equipment. Equipping Shop to Heat Economically, E. F. Davis. Iron Trade Rev., vol. 80, no. 17, Apr. 28, 1927, pp. 1073-1076 and 1081, 5 figs. Essentials of up-to-date heat-treating department from metallurgical viewpoint; pearlite is most important constituent in steel and has an important effect upon machinability; hardness of metal has nothing whatever to do with machining conditions; gears from which specimens were taken were annealed in stationary furnaces and investigation revealed impossibility of producing uniform annealing in batch furnaces.

STEEL, HIGH-SPEED

MANUFACTURE. High-Speed Steels, F. C. A. H. Lantsberry. Am. Soc. Steel Treating—Trans., vol. 11, no. 5, May 1927, pp. 711-725 and (discussion) 725-729 and 803, 4 figs.

STREET RAILWAYS

CAR-STEERING DEVICE. Developments in Tramcar Design. Tramway & Ry. World, vol. 61, no. 19, Apr. 14, 1927, pp. 189-191, 7 figs. Jonkhoff automatic steering device is based on principle of making use of difference in direction which occurs, when negotiating curves, between axis of body of vehicle and axis of pivoting trucks.

CAR TRUCKS. Car Trucks with Automotive Drive. Elec. Traction, vol. 23, no. 4, Apr. 1927, pp. 197-198, 2 figs. Two electric-railway companies design worm-drive street car trucks to reduce unsprung weight, increase speed, eliminate noise and promote riding comfort.

STREETS

WIDTHS. Street Widths and Traffic Problems in American and European Cities, W. H. Tiedeman. West. Constr. News, vol. 2, no. 8, Apr. 25, 1927, pp. 34-37. Author ascribes existence of wide thoroughfares to three causes: accidental, deliberate planning and widening from necessity; each of these are discussed.

SUBSTATIONS

AUTOMATIC. Electrical Development at Ilford. Elec. Rev., vol. 100, no. 2576, Apr. 8, 1927, pp. 547-548, 4 figs. Conversion of 1,000-kw. manually operated rotary substation at Goodmayes to automatic working, utilizing existing machines and introducing new and interesting features in automatic installation work. See also Elecn., vol. 98, no. 2549, Apr. 8, 1927, p. 387, 2 figs.

HIGH-VOLTAGE. High-Voltage Substation Design. Elec. World, vol. 89, no. 19, May 7, 1927, pp. 962-964, 3 figs. Practice of Duquesne Light Co.; insulation used and protection by balanced relays; specifications of equipment.

High-Voltage Substation Design. Elec. World, vol. 89, no. 18, Apr. 30, 1927, pp. 901-903, 6 figs. Practices of Detroit Edison Co.; insulation, drainage and construction arrangements; reliability and simplicity stressed in designs.

REMOTE-CONTROL. Remote-Control High-Tension Station, J. Bankus. Elec. World, vol. 89, no. 17, Apr. 23, 1927, pp. 854-855, 3 figs. Sixty-kv. switching station controlled from manual station 1½ miles away through 19-conductor cable; metering also remotely handled.

T

TANKS

CONCRETE. A Contribution to the Calculation of Circular Tanks in Reinforced Concrete, H. Carpenter. Concrete and Constr. Eng., vol. 22, no. 4, Apr. 1927, pp. 237-241, 5 figs. Approximate method of obtaining restraint moment. Present examples from which it is seen that the bigger the radius and stiffer the wall the greater will be restraint moment, result that is well in agreement with practical considerations.

TAPS

SCREW THREADS. Standards Committee Division Reports. Soc. Automotive Engrs.—Jl., vol. 20, no. 5, May 1927, pp. 559-564. Machine screw taps, cut and ground threads; hand plug taps, cut and ground threads; tapper taps, ground and cut threads.

TELEPHONY

AUTOMATIC SWITCH. An Automatic Telephone Switch. Elec. Rev., vol. 100, no. 2578, Apr. 22, 1927, pp. 637-638, 3 figs. Quick-acting switch which can be manufactured on large scale very cheaply; it can be constructed and arranged in very simple manner to act as linefinder, call distributor with many outlets, group selector or final selector.

TEXTILE MILLS

TANDEM DRIVE CONTROL. Tandem Drive Control in a Textile Plant, R. T. Kintzing. Elec. World, vol. 89, no. 18, Apr. 30, 1927, pp. 915-916, 3 figs. Tandem or train drive for process involving continuous printing of patterns on rugs, setting dyes and drying material.

TIME STUDY

MORALE AS FACTOR IN. Morale as a Factor in Time Study Technique, M. L. Cooke. Taylor Soc.—Bul., vol. 7, no. 2, Apr. 1927, pp. 331-337 and (discussion) 341-343. As illustrated by a recent investigation of production standards used in garment industry in Cleveland.

TIN DEPOSITS

BRITISH EMPIRE. The Empire's Tin Resources, R. Pawle. Instn. Min. & Met.—Bul., no. 271, Apr. 1927, pp. 1-24. Account of British Empire's tin resources; deposits in United Kingdom; Nigeria; Gold Coast; Southern Rhodesia; South-West Africa territory; Swaziland; Tanganyika territory and Uganda; Union of South Africa; Canada; India; New Zealand.

TIN ORES

CARBON REDUCTION. The Gaseous Nature of Carbon Reduction of Tin Concentrates, C. G. Fink and C. L. Mantell. Am. Electrochem. Soc.—Advance Paper, no. 38, for mtg. Apr. 28-30, 1927, pp. 371-381, 1 fig. Tin ores and their characteristics; carbon reduction is shown to be possible only by passage of carbon into gaseous phase through oxidation; upon heating to high temperature mixture of tin oxide and coke in atmosphere of nitrogen, no metallic tin was produced; commercial smelting of tin ores by carbon.

TIRES, RUBBER

PNEUMATIC. Puncture-Sealing Compounds for Pneumatic Tires. U.S. Bur. Standards—Circ., no. 320, Jan. 11, 1927, pp. 1-5. Different methods which are employed to render tires "puncture-proof" or self-sealing against punctures; discussion of type which is most common; arguments for and against use of such puncture-sealing compounds.

TRANSFORMERS

CONSTANT-CURRENT. Constant-Current Regulating Transformer Characteristics, H. C. Louis and A. Albaugh. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 5, May 1927, pp. 421-425, 9 figs. Special tests show radical differences from conventional assumptions; performance specifications should be based on actual total losses for all loads and not on conventional assumption of constant total losses, as has been done in past.

INERTAIRE. Service Operation of Inertaire Transformers, L. H. Hill. Power Plant Eng., vol. 31, no. 9, May 1, 1927, pp. 517-520, 6 figs. Includes reports on operation of actual installations.

OPERATION. Power Transformer Operation, D. W. McJannet. Elec. Rev., vol. 100, no. 2577, Apr. 15, 1927, pp. 589-592, 11 figs. Describes and compares various systems at present in use, or available for use, for protection of electrical apparatus in their application specifically to power transformers, including two recent introductions by Brit. Thomson-Houston Co. and Johnson & Phillips.

OUTDOOR. High-Voltage Outdoor Transformers. Engineer, vol. 143, no. 3721, May 1927, p. 503, 4 figs. on p. 496. Details of 13,300-kva., 110,000-volt units for transmission system in Chile; they are of Ferranti standard double-wound core type.

RAILWAY AND HIGHWAY. The Relation of Highway Transportation to the Railway, R. Budd. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 793-812, 2 figs. Superiority of railway for long-distance and bulk freight and passenger traffic is well established; motor truck and bus competition is not a factor in those fields; extensive ownership of automobiles and large mileage of improved highways have resulted in loss of most of local passenger travel of railways, except in vicinity of largest cities; bus business promises to increase if better service can be given and if cost of operation can be reduced; recommended restrictions on motor vehicle sizes, weights and speeds; equitable principles for interstate regulation.

TUBES

NON-FERROUS METAL. Manufacture of Non-Ferrous Metal Tubes by Hydraulic Extrusion, W. Kurz. Metal Industry (Lond.), vol. 30, no. 13, Apr. 1, 1927, pp. 333-335, 4 figs. Methods and appliances applied in processes in Continental Europe; extruding other metals; sizes of billets for extrusian; steel tools for extrusion presses.

TUNNELLING

CASCADE RANGE. WASHINGTON. Great Northern Railway Driving Long Tunnel Through Cascade Range, R. G. Skerrett. Compressed Air Mag., vol. 32, nos. 3, 4 and 5, Mar., Apr. and May 1927, pp. 1933-1941, 1975-1982 and 2006-2014, 58 figs. This will be longest railroad tunnel so far undertaken in United States; it will be 7.79 miles between portals; work is of outstanding interest owing to nature of ground penetrated and because of facilities used to carry job forward with all practicable dispatch; progress records have been broken on several occasions. Apr. and May: Tunnel and operating methods at West Portal and Mill Creek.

TUNNELS

SHANDAKEN, N.Y. The Shandaken Tunnel, R. W. Gausmann. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 681-706, 9 figs. Tunnel extending between Prattsville and Shandaken, N.Y., is about 18 miles in length, longest yet built; it connects two water sheds, making run-off of Schoharie Creek as impounded by Gilboa Dam on the north available to Esopus water shed on the south; development of this project and geology of region; drilling, dynamiting, mucking, timbering and concrete lining operations; mechanical equipment, progress and costs; use of concrete gun, organization problems for efficient progress, and transportation.

V

VAPORS

PRESSURE. Equation of Vapor Pressure at Low Temperatures (Ueber die Dampfspannungsgleichung bei tiefen Temperaturen), V. Fischer. Zeit. für Physik, vol. 39, no. 10-11, Nov. 16, 1926, pp. 879-882. In previous paper author deduced equation of vapor pressure on assumption that change of volume of liquid or solid state in domain considered could be neglected; in present paper he deduces equation without this assumption.

PRESSURE MEASUREMENT. Vapor Pressure and Heat of Dilution of Aqueous Solutions, H. I. Downes and E. P. Perman. Faraday Soc.—Trans., vol. 23, no. 73, Mar. 1927, pp. 95-106, 1 fig. Improved method of measuring vapor pressure by air bubbling.

VENTILATION

ROOF VENTILATORS. A Proposed Set-Up for Testing Automatic Roof Ventilators, G. D. Beals. Heat. & Vent. Mag., vol. 24, no. 5, May 1927, pp. 59-61, 1 fig. Why "wind-tunnel" method is favoured, sizes of ventilators to be tested and how ratings should be expressed.

VIADUCTS

TIMBER. Timber Viaduct Over the Tunuyan River, T. C. S. Haslam. Instn. Civ. Engrs.—Sessional Notices, no. 4, May 1927, pp. 102-104. Consists of 31 bents of 4 piles each, spaced 4 m. apart centre to centre; 14-in. by 14-in. piles are of pitch pine treated with two coats of "carbolineum" preservative and shod with heavy cast-iron shoes.

REINFORCED-CONCRETE. Old Iron Viaduct Converted to Reinforced-Concrete Structure, J. F. Hough. Eng. News-Rec., vol. 98, no. 16, Apr. 21, 1927, pp. 650-654, 6 figs. In constructing Beck memorial bridge at Lynchburg, Va., use of old structure secured economy and minimized interruption of traffic; flexible expansion walls; method of cutting old steel at joints.

VOLTAGE REGULATION

REGULATORS. Systematic Care of Generator Voltage Regulators, R. B. Greenwood. Power, vol. 65, no. 17, Apr. 26, 1927, pp. 626-628, 2 figs. Troubles experienced when regulators were first put into service and how these were eliminated; inspection and maintenance methods employed to keep regulators in condition so that they function in satisfactory manner.

VOLTAGES

RATIO AND PHASE DISPLACEMENT. The Measurement of the Ratio and Phase Displacement of High Alternating Voltages, B. G. Churcher. Instn. Elec. Engrs.—Jl., vol. 65, no. 364, Apr. 1927, pp. 430-439, 6 figs. Null methods of measuring ratio and phase displacement of two alternating voltages; particularly applicable to high voltages; they are discussed in connection with testing of power transformers and potential transformers; testing of high-voltage potential dividers.

STANDARDIZATION. Voltage Standardization of A.C. Systems from the Viewpoint of the Electrical Manufacturer, F. C. Hanker and H. R. Summerhayes. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 5, May 1927, pp. 438-446, 2 figs. Also Elec. World, vol. 89, no. 20, May 14, 1927, pp. 1010-1013. Proposed system starts with already standardized utilization voltages of low end of scale and suggests transformer voltage ratings and ratios which will allow proper voltage to be supplied to consumers without over-exciting any of transformers or generators in system, and ties in transformer and apparatus voltages with system voltages, based on A.I.E.E. definition of rated circuit voltages.

W

WALLS

AIR LEAKAGE THROUGH. Infiltration Through Plastered and Unplastered Brick Walls, F. C. Houghten and M. Ingels. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 4, Apr. 1927, 8 figs. Infiltration is large factor in total heat loss through unplastered brick wall; loss amounts to from 30 to 40 per cent of total heat loss through such a wall; plaster either when applied directly on brick or with furring, lath and plaster, is very effective in reducing heat loss by infiltration.

WATER HAMMER

THEORIES. Comparison and Limitations of Various Water Hammer Theories, R. S. Quick. Mech. Eng., vol. 49, no. 5a, mid-May 1927, pp. 524-530, 13 figs. Confirmation of accuracy of elastic-water-column theory by experimental test data; charts graphically solving problems of maximum pressure rise with uniform gate motion and complete closure.

WATER METERS

PITOMETERS. The Pitometer Survey in the Improvement and Maintenance of a Distribution System, M. Serkes. Am. Water Works Assn.—Jl., vol. 17, no. 4, Apr. 1927, pp. 456-463. In 1912 water division of St. Louis adopted pitometer as means of detecting, measuring and curtailing its waste of water; method of making survey; result of recent survey; revision in distribution system; examples of savings; water-main cleaning; testing meters in place. See also Am. City, vol. 36, no. 4, Apr. 1927, p. 466.

WATER POLLUTION

OIL-CONTAMINATED WATER. Typical Methods and Devices for Handling Oil-Contaminated Water from Ships and Industrial Plants, F. W. Lane, A. E. Bauer, H. F. Fisher and P. N. Harding. U.S. Bur. of Mines—Tech. Paper, no. 385, 1926, pp. 1-66, 14 figs. Certain methods and devices chosen as typical are discussed more with respect to their adaptability than to details of operation and construction; they comprise two classes, those designed to dispose of oil-contaminated water and other oil waters by use of facilities provided on land or in port, and those designed for use on ships.

WATER POWER

MANITOBA. Wonderful Water Powers of Manitoba. Elec. News, vol. 36, no. 8, Apr. 15, 1927, pp. 27-30, 4 figs. Nelson River alone has nearly 4,000,000 h.p.; Whitemud Falls likely first to come under control.

CANADA. Development of Water Power in Canada. Can. Engr., vol. 52, no. 17, Apr. 26, 1927, pp. 469-472. Review of water power resources in Dominion prepared by Dominion Water Power and Reclamation Service of Department of Interior; large water powers available for industry awaiting development.

WATER SUPPLY

TORONTO, ONT. Toronto's Additional Water Supply to Cost Over $14,000,000. Eng. News-Rec., vol. 98, no. 15, Apr. 14, 1927, pp. 616-617, 2 figs. Lake intake tunnel with steel pipe extension treatment works, land tunnel, pumps, force mains and reservoirs.

PROVINCIAL PROTECTION. Protection of Provincial Water Supplies. Can. Engr., vol. 52, no. 17, Apr. 26, 1927, pp. 461-463. Measures taken by health authorities in various provinces to protect public; boards of health where organized to exercise control over water supplies and water works systems as well as springs, etc.

WATER TREATMENT

CHLORINATION. Chlorination for Algæ Control, C. Cohen. Am. Water Works Assn.—Jl., vol. 17, no. 4, Apr. 1927, pp. 444-445, 2 figs. Algæ troubles in small reservoirs; since chlorine can be employed as combined bactericide and algicide, expense of installation and operation of additional chlorination units is not excessive; simplicity and economy of chlorine application and minimum of labour and experience involved recommend its use; since chlorine does not remain in treated water no danger exists in cases of over-dosing; from field and laboratory data chlorine appears to possess merits that make it worthy of greater consideration in algæ control work.

WATER WORKS

VALUATION. Notes on the Rating and Valuation of Waterworks in Relation to Taxation, J. Chisholm. Water & Water Eng., vol. 29, no. 340, Apr. 20, 1927, pp. 141-144. Particulars submitted for purpose of introducing discussion on subject.

WELDING

ELECTRIC. *See Electric Welding, Arc.*

HEATING SYSTEMS. Welding in Plumbing and Heating, S. E. Dibble. Welding Engr., vol. 12, no. 4, Apr. 1927, pp. 42-44, 11 figs. Experimental installation shows advantages of welding torch in assembling low-pressure heating systems.

OXY-ACETYLENE. *See Oxy-Acetylene Welding.*

STEEL PIPE. Welded Pipe for Water System, W. P. Brown. Welding Engr., vol. 12, no. 4, Apr. 1927, pp. 27-29, 5 figs. All field joints were acetylene welded, tank gas being used; in very deep cuts pipe was welded on high horses, lowered to 40-in. level and tied into line and then whole line lowered to bottom of ditch; saving of time and money by using welding process.

THERMIT. Mill Parts Are Reclaimed by New Welding Process. Iron Trade Rev., vol. 80, no. 18, May 5, 1927, pp. 1139-1140. New improved method of making thermit weld is important economic factor in reclamation work.

WIND TUNNELS

CLOSED TYPE. Wall Interference in Closed Type Wind Tunnels, G. J. Higgins. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 256, Mar. 1927, pp. 1-6, 10 figs. Tests conducted in variable-density wind tunnel on several airfoils of different sizes and sections to determine effect of tunnel-wall interference and to determine correction which can be applied to reduce error caused thereby; use of several empirical corrections was attempted with little success; Prandtl theoretical correction gives best results and its use is recommended for correcting closed-wind-tunnel results to conditions of free air.

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A

ABRASIVES

AUTOMOBILE PLANTS. Abrasive Engineering Practice in Automobile Manufacturing Plants, F. B. Jacobs. Abrasive Industry, vol. 8, no. 6, June 1927, pp. 182-184. Presents list of grinding-wheel manufacturers' trade names; fully 95 per cent of all abrasives used in automobile factories fall under two heads; carbide of silicon and manufactured alumina.

AERONAUTICS

PROBLEMS. Aeronautics, A. Guidoni. Roy. Aeronautical Soc.—Jl., vol. 31, no. 197, May 1927, pp. 420-444. Presents chief problems which arise in aeronautical field, so as to form idea for their solution; problems of aircraft design; law of power and weight; accidents; improvements to be effected; personnel and material; air-force organization.

AIR COMPRESSORS

EXPLOSION PREVENTION. Installation and Operation of Air Compressor Plants for Avoidance of Explosions, W. Greenwood. Iron & Steel Engr., vol. 4, no. 5, May 1927, pp. 229-232. Describes conditions that are responsible for explosions within air receivers and piping; presents code of rules for safe installation and operation of air-compressor plants, rules in most instances being accompanied by notes containing suggestions or explanatory matter.

AIRPLANE ENGINES

DYNAMIC FORCES. Dynamic Forces in Aircraft Engines, B. C. Carter. Roy. Aeronautical Soc.—Jl., vol. 31, no. 196, Apr. 1927, pp. 278-309 and (discussion) 309-328, 18 figs.

RADIATORS. Resistance and Cooling Power of Various Radiators, R. H. Smith. Nat. Advisory Committee for Aeronautics—Report, no. 261, 1927, 16 pp., 16 figs.

AIRPLANE PROPELLERS

DESIGN. Some Notes on the Design of Airscrews, F. S. Barnwell. Instn. Aeronautical Engrs.—Jl., vol. 1, no. 5, May 1927, pp. 56-77 and (discussion) 77-83, 6 figs. Deals with simple blade-element theory; means for determining effect of body on tractor air propeller and effect of air propeller on body; metal propellers.

SECTIONS. Characteristics of Propeller Sections Tested in the Variable Density Wind Tunnel, E. N. Jacobs. Nat. Advisory Committee for Aeronautics—Report, no. 259, 1927, 16 pp., 18 figs.

AIRPLANES

AIRFOILS. Determining the Velocity Distribution in the Boundary Layer of an Airfoil Fitted with a Rotary Cylinder, B. G. Van der Hegge Zijnen. Nat. Advisory Committee for Aeronautics—Tech. Memorandum, no. 411, May 1927, pp. 1-15, 9 figs.

The Effect of a Flap and Ailerons on the N.A.C.A.—M6 Airfoil Section, G. J. Higgins and E. N. Jacobs. Nat. Advisory Committee for Aeronautics—Report, no. 260, 1927, 18 pp., 24 figs.

CANADIAN INDUSTRY. The Canadian Aircraft Industry. Aeroplane, vol. 32, no. 19, May 11, 1927, pp. 534, 543-544, 546 and 548, 5 figs. Types of planes developed in Canada.

DESIGN. Some Notes on the Design of Commercial Aircraft from the Operational Point of View, R. H. Mayo. Roy. Aeronautical Soc.—Jl., vol. 31, no. 197, May 1927, pp. 359-373 and (discussion) 374-392.

AIRSHIPS

DEVELOPMENT AND FUTURE. The Development and Future of the Airship, E. E. H. Evans. Instn. Aeronautical Engrs.—Jl., vol. 1, no. 5, May 1927, pp. 50-53.

ALLOYS

EUTECTIC, STRUCTURE OF. The Application of Strain Methods to the Investigation of the Structure of Eutectic Alloys, F. Hargreaves. Inst. of Metals—Advance Paper, no. 421, for mtg. Mar. 9-10, 1927, 3 pp., 11 figs. Investigation of lead-tin, tin-zinc and copper-silver eutectics shows that straining by suitable methods results in markings, due to slip, similar to those which occur in case of pure metals; orientation of lead-tin eutectic is apparently determined by that of tin.

ALUMINUM BRONZE

IMPROVEMENT OF. Improvement of Aluminum Bronze as an Engineering Material, R. C. Reader. Am. Foundrymen's Assn.—Advance Paper, no. 17, for mtg. June 6-10, 1927, 9 pp. Deals with influence of added elements; effects of addition of iron, nickel, manganese; use of chill castings; casting and mould temperatures; mould designs and position of casting in mould; position of feeder heads; heat treatment.

AMMONIA CONDENSERS

SHELL-AND-TUBE. Modern Shell and Tube Ammonia Condensers, W. H. Motz. Power, vol. 65, no. 23, June 7, 1927, pp. 882-884, 7 figs. Construction and operation of latest types used in refrigerating plants; single-pass multi-tubes type; features of construction; operating characteristics.

AQUEDUCTS

DISCHARGE DETERMINATION. Experimental Determination of Hydraulic Constants in a Large Aqueduct, J. N. Finlayson. Eng. Jl., vol. 10, no. 6, June 1927, pp. 297-301, 7 figs. Series of tests to determine discharge of Greater Winnipeg Water District concrete aqueduct by use of salt-velocity method.

ASBESTOS

MINING AND MILLING. Asbestos—Mining and Milling, J. G. Ross. Can. Min. & Met. Bul, no. 181, May 1927, pp. 527-560, 18 figs. Occurrence in Canada; geology of producing area; character of asbestos; uses; mining methods; cable-way hoist; wet milling; production; manufacturing.

AUTOMOBILE ENGINES

CRANKCASE OIL RECOVERY. Crankcase Oil Reclaiming System Developed by Sharples. Automotive Industries, vol. 56, no. 21, May 28, 1927, pp. 804-805, 2 figs. Drainings are charged into treating tank, clarifying solution added and mixture agitated by pump; separated in centrifuge after passing through heater coils; three systems of heating.

HEAVY OIL. High-Speed Oil Engines for Vehicles, L. Hausfelder. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 410, May 1927, pp. 1-32, 53 figs. Author predicts that two-stroke cycle will determine future of small Diesel engine for vehicles.

AUTOMOTIVE FUELS

AIRCRAFT. Safe Aircraft Fuels (Les carburants de sureté pour avions), A. Grebel. Génie Civil, vol. 90, nos. 14, 15 and 16, Apr. 2, 9 and 16, 1927, pp. 331-337, 361-364 and 380-382, 4 figs.

CHARCOAL SUCTION GAS. Suction Gas for Commercial Vehicles. Engineer, vol. 143, nos. 3721 and 3722, May 6 and May 13, 1927, pp. 488-490 and 516-517, 5 figs. Discusses methods and apparatus for making charcoal continuously or for recuperating by-products in entirely enclosed receptacles; disadvantages in use of suction gas for motor vehicles; eleven firms ran suction-gas vehicles between Blois, where exhibition was held, to Forest of Menars, where demonstration of carbonizing apparatus was in progress.

AVIATION

AIRPORT LIGHTING. Night Flying Equipment for the Airdrome, W. T. Harding. Aviation, vol. 22, nos. 21 and 22, May 23 and 30, 1927, pp. 1079-1081 and 1141-1144, 7 figs. May 23: Authoritative discussion of present status in development of airport lighting. May 30: Landing-field floodlights; various methods of floodlighting, comparing merits.

B

BEAMS

REINFORCED CONCRETE. Hodgkinson System of Reinforced Concrete Beams. Engineering, vol. 123, no. 3198, Apr. 29, 1927, p. 527. Experimental beam constructed on system devised by A. J. Hodgkinson; aimed at reducing to a minimum amount of shuttering or shoring required in process of construction.

BEARINGS

ANTI-FRICTION. Anti-Friction Bearings for Railway Rolling-Stock. Ry. Engr., vol. 48, no. 569, June 1927, pp. 228-231, 5 figs. Experience in Europe has demonstrated considerable advantages; refers to very favourable results obtained in Denmark, France, Germany, and also in United States; tests on roller-bearing boxes on Vaster-Götland Gothenburg Railway.

LUBRICATION. The Lubrication of Waste-Packed Bearings, G. B. Karelitz. Mech. Eng., vol. 49, no. 6, June 1927, pp. 663-670, 17 figs. Based on results of investigation made by Westinghouse Electric and Manufacturing Co., author discusses feeding of oil through waste and existence of load-carrying oil film in waste-packed bearings as essential for their proper performance.

BEARINGS, BALL

TRANSMISSION. Experimental Study of Transmission Bearings (Etude experimentale des paliers de transmission), C. Hanocq. Revue Universelle des Mines, vol. 14, nos. 1 and 3, Apr. 1, 1927, and May 1, 1927, pp. 5-20 and 93-104, 21 figs. Results of experiments carried out at machine construction laboratory at University of Liège on ball bearings.

BEARINGS, ROLLER

RAILWAY. Advantages of the Roller Bearing and Locomotive Booster. Ry. & Locomotive Eng., vol. 40, no. 5, May 1927, pp. 127-130, 3 figs. Demonstrated in operating suburban passenger trains on C.M. & St.P. Ry.

BELT DRIVE

CENTRE DISTANCES. Factors in Determining Proper Centre Distances for Leather Belt Drives, R. C. Moore. Indus. Engr., vol. 85, no. 5, May 1927, pp. 201-204, 4 figs. Considerations in connection with determining proper distance between pulleys.

BLAST FURNACES

Gases and Ore Interaction. The Interactions of Gases and Ore in the Blast-Furnace, W. A. Bone, L. Reeve and H. L. Saunders. Engineering, vol. 123, no. 3199, May 6, 1927, pp. 564-566, 8 figs; also Iron & Coal Trades Rev., vol. 114, no. 3089, May 13, 1927, pp. 773-777, 6 figs. Experiments to ascertain by best laboratory methods available, facts concerning interactions between oxides of carbon, when diluted with much the same proportion of nitrogen as in blast-furnace gas, and oxides of iron, at temperatures between 380° and 650° cent., which is important range from point of view of " carbon deposition " in furnace. Paper read before Iron and Steel Inst.

BOILER FEEDWATER

Hydrogen-Ion Concentration in. Potentiometric Determination of Hydrogen Ion Concentrations in Boiler Waters, W. N. Greer and H. C. Parker. Am. Water Works Assn.—Jl., vol. 17, no. 5, May 1927, pp. 569-582, 7 figs. Alkalinity measurements as means of approximating H-ion concentration; determination of hardness by soap method gives, at best, only approximate value; there is more or less definite relation between alkalinity and pH of natural waters at lower alkalinities; use of hydrogen and quinhydrone and tungsten electrodes.

Treatment. Some Notes on Feed Water Treatment, A. Seton. Eng. & Boiler House Rev., vol. 40, no. 11, May 1927, pp. 569-570. Most of failures which are recorded are directly due to water and its dissolved constituents, including gases and oil in suspension; ideal plan, which is not always practicable, is to condense all steam after use, and to use condensate as make-up; under best conditions, 90 per cent of steam generated may be recovered in this way; softening of boiler water.

BOILER FURNACES

Air Preheating. The Influence of Preheated Air on Combustion Process (Die Beeinflussung des Verbrennungsvorganges durch vorgewärmte Luft), W. Gumz. Feucrungstechnik, vol. 15, no. 12, Mar. 15, 1927, pp. 133-137, 5 figs.

Gas Stratification, Effect of. Effects of Furnace Gas Stratification on Overfeed Stoker Efficiency, H. H. Baumgartner. Nat. Engr., vol. 31, no. 6, June 1927, pp. 263-266, 3 figs. Stratification of furnace gases under different operating conditions; functions of furnace arches in chain-grate stoker furnaces; preheated air and its practical applications.

Pulsatory Combustion. Process for Better Utilization of Fuel (Verfahren zur besseren Ausnutzung der Brennstoffe), Franke. Wärme, vol. 50, no. 9, Mar. 4, 1927, pp. 174-175.

Radiant Heat, Effect of. Effect of Radiant Heat on Water-Cooled Furnace Walls, A. G. Christie. Power, vol. 65, no. 22, May 31, 1927, pp. 841-844, 4 figs. Discussion of what happens in water screens, water walls and first row of boiler tubes, velocities attained and probable rates of heat absorption.

BOILER OPERATION

Central Stations. Power House Boiler Operation, R. B. Mitchell. World Power, vol. 7, no. 42, June 1927, pp. 319-325, 6 figs. After showing differences between boiler-house operation in electricity-supply industry and that practice in other industries, author outlines modern methods in typical large-scale generating station, laying stress on necessity for ascertaining accurately amount of coal consumed; instruments to be installed and method of logging and recording readings.

BOILER PLANTS

Automatic Control. Automatic Control of Boiler Plants. Power, vol. 65, no. 22, May 31, 1927, pp. 814-817, 9 figs. Boiler-plant automatic control, by which all boilers in plant may be controlled as unit, has made rapid advances during last few years; describes number of these systems.

Auxiliary Drive. Drives for Power Plant Auxiliaries, F. T. Leilich. Iron & Steel Engr., vol. 4, no. 5, May 1927, pp. 218-225 and (discussion) 225-229, 14 figs. No general statement as to what is best can be made, as conditions are different for practically every case; numerous factors contributing to increase in use of electricity.

Equipment. Industrial Boiler Plant, D. Brownlie. World Power, vol. 7, no. 41, May 1927, pp. 261-270, 13 figs. Deals with plant, machinery and appliances; and control by means of water meters, steam meters, coal weighers, flue-gas analyzing machines, pyrometers and similar appliances.

Practice. Modern Boiler House Practice, J. T. Ruddock. Machy. Market, no. 1385, May 20, 1927, pp. 21-22. Deals with brickwork, furnace-wall design, side sealing, running with minimum supply of air, growth of cast-iron links. Paper read before Bradford Eng. Soc.

BOILER PLATE

Electric Arc Welding. Arc Welding of Boiler Plates, N. Shaposhikoff, G. Kastzenko and K. Jourieff. Inst. Economic Mineralogy & Met.—Trans., no. 31, 1927, 76 pp., 25 figs. Strength tests, chemical analysis and metallographic studies of V and double-V welds, made at Mining and Metallurgical Laboratory of Leningrad; joining plates, new with new and old with old; results of strength and bending tests very satisfactory; favors V joint for thinner plates, double V for thicker; commends annealing, but objects to hammering of welds. (In Russian.)

Embrittlement. Embrittlement of Boiler Plate, S. W. Parr and F. G. Straub. Am. Soc. Testing Matls.—Advance Paper, no. 29, for mtg. June 20-24, 1927, 15 pp., 4 figs. Term embrittlement of boiler plate is defined as intercrystalline cracking in riveted seams. See also Indus. & Eng. Chem., vol. 19, no. 5, May 1927, pp. 620-622, 5 figs.

BOILER TUBES

Reclamation. Most Efficient Methods of Reclaiming and Safe-ending Boiler Tubes and Flues. Boiler Maker, vol. 27, no. 5, May 1927, pp. 139-143, 10 figs. Abstract of Committee report presented to Master Boiler Makers' Assn.

BOILERS

Blow-Off System. Design and Operating Problems of the Boiler Blow-Off System, C. L. Hubbard. Nat. Engr., vol. 31, no. 6, June 1927, pp. 257-261, 5 figs. Practical suggestions on proper methods of blowing down boiler, how to maintain proper concentration of boiler water and suggestions on installation of boiler blow-off combinations.

Drum Manufacture. Manufacture of High-Pressure Boiler Drums. Iron Age, vol. 119, no. 18, May 5, 1927, p. 1300. Welding of longitudinal seams 3½ in. thick and upsetting of ends to close in head; methods of Thyssen firm in Germany.

Electric. Load Control on Electric Steam Boilers, C. R. Reid. Power, vol. 65, no. 24, June 14, 1927, p. 911, 2 figs. Electric boiler started cold with clean water at minimum level will have initial input about 10 per cent of normal rating; continuous operation at 25 per cent rating is about as low as is practicable, because amount of bleeder water becomes excessive.

Failures. Boiler Failures. Engineering, vol. 123, no. 3199, May 6, 1927, pp. 552-553. Review of memorandum by C. E. Stromeyer in which he gives list of exhibits in his museum and valuable comments upon them.

Heads. Calculation of the Plate Thickness of Dished Heads and Knuckles According to the Hamburg Rules, A. Huggenberger. Mech. Eng., vol. 49, no. 6, June 1927, pp. 629-632, 6 figs. Stress conditions in elliptical shells are established from theoretical and experimental analyses. Translated from V.D.I. Zeit., vol. 69, no. 6, Feb. 7, 1925, pp. 159-162.

Experiments on the Resistance and Change of Shape of Boiler Heads, C. Bach. Mech. Eng., vol. 49, no. 6, June 1927, pp. 635-636, 5 figs. Experiments cover six boiler heads of elliptical cross-section; six boiler heads of usual shape; four boiler heads of shape designed by Klooper. Translated from V.D.I. Zeit., vol. 69, no. 12, Mar. 21, 1925, pp. 367-368.

BRAKES

Band. Band of Strap Brakes, Corliss. Mech. World, vol. 81, no. 2108, May 27, 1927, p. 371, 1 fig. Author seeks to show that, with help of accompanying table, calculation of brake effort given by existing brake or design of new one, can be effected in few minutes.

BRIDGE ERECTION

Long Spans. Erecting Long Bridge Spans Over Niagara River. Eng. News-Rec., vol. 98, no. 20, May 19, 1927, pp. 802-806, 4 figs. Superstructure work of Buffalo-Fort Erie bridge handled with help of ingenious system of removable steel spud cribs as falsework supports; entire erection carried out in one season.

Main Bearings. The Main Bearings of Sydney Harbour Bridge. Engineering, vol. 123, no. 3201, May 20, 1927, pp. 618-620, 8 figs. Work of erecting four main bearings which will transmit thrust from arch ribs to masonry piers.

BRIDGES, SUSPENSION

Stiffened. The Theory of the Stiffened Suspension Bridge. Engineering, vol. 123, no. 3198, Apr. 29, 1927, pp. 506-508, 3 figs. Shows that distortion of chain can always be regarded as sum of two different types of distortion, one of which is symmetrical about centre line of bridge and other is equal and opposite on opposite sides of this centre; it is these distortions which are most important, and such distortion involves no change in position of centre of gravity of dead load, and is, therefore, not resisted by latter; numerical results of analysis confirm Moisseiff's claim that stresses on stiffening girder are only about half as great as if calculated on older hypothesis.

BUILDING MATERIALS

Combustible. Standard Fire Tests for Combustible Building Materials, M. E. Dunlap and F. P. Cartwright. Am. Soc. Testing Matls.—Advance Paper, no. 77, for mtg. June 20-24, 1927, 5 pp. Standard fire tests of treated combustible building materials are desirable to disclose their relative effectiveness; to afford control for their use in construction; and to secure uniformity of treatment; such tests are not now generally in use, and are only partial in scope where used, but afford basis for development.

Hollow Masonry. Report of Committee C-10 on Hollow Masonry Building Units. Am. Soc. Testing Matls.—Advance Paper, no. 50, for mtg. June 20-24, 1927, 6 pp. Standard specifications and tests for hollow burned-clay, load-bearing wall tile; tentative specifications and tests for hollow burned-clay floor tile.

C

CABLES, ELECTRIC

Metal-Sheathed Cores. 33,000-Volt Cables with Metal-Sheathed Cores, with Special Reference to the Separately Lead-Covered Type, P. Dunsheath. Instn. Elec. Engrs.—Jl., vol. 65, no. 365, May 1927, pp. 469-478 and (discussion) 478-498, 19 figs. Various types of multi-core cable with metal sheaths over individual cores are enumerated and their advantages over plain 3-core type detailed; claims of S.L. type, in which each core is separately lead-covered, over other metal-sheathed-core types, in which common lead sheath covers all three cores; practical formula for calculating sheath effects in single core cable, together with results of series of tests carried out to determine extent of these effcts in S.L. typ.

Sheath Alloys. Fatigue Studies of Telephone Cable Sheath Alloys, J. R. Townsend. Am. Soc. Testing Matls.—Advance Paper, no. 39, for mtg. June 20-24, 1927, 13 pp. 12 figs. Fatigue studies of lead sheath for telephone cables, development of two forms of simulated service test and fatigue machine designed to test lead and its alloys; special precautions necessary in carrying out fatigue tests on soft metals; fatigue failure of lead and lead-antimony alloys is by intergranular failure; in case of lead-antimony alloys repeated stress appears to reduce solid solubility of antimony in lead, producing widened grain boundary as viewed under microscope.

Testing. Testing Equipment for H.T. Cables, C. M. Perrin. Elec. Times, vol. 71, no. 1857, May 26th, pp. 720-721, 4 figs. Details of equipment employed by Shanghai Municipal Electricity Department.

CAMS

Circular-Arc. Graphical Analysis of Circular-Arc Cams—Discussion, G. L. Guillet. Am. Mach, vol. 65, no. 24, June 16, 1927, pp. 1012-1013, 2 figs. Supplementary to author's previous articles, and to remarks of Schreck on p. 322, vol. 66.

CARBON

Combustion. The Combustion of Solid Carbon, R. T. Haslan. Eng. & Boiler House Rev., vol. 40, nos. 7 and 11, Jan. and May 1927, pp. 355-360 and 580-582, 2 figs. Deals with reaction $C + O_2 = CO_2$, and summarizes and discusses information in literature on mechanism of reaction and factors determining its rate. Paper read before Instn. Fuel Technology.

CAST IRON

Handling and Melting. Handling and Melting Grey Iron. Iron Age, vol. 119, no. 22, June 2, 1927, pp. 1587-1590, 5 figs. Washing-machine plant has several novel features in continuous-pour foundry; double-magnet crane.

Welding. The Welding of Cast Iron, P. L. Roberts. Welding Jl., vol. 24, no. 282, Mar. 1927, pp. 70-76, 11 figs; and (discussion) no. 283, Apr. 1927, pp. 102-106. Both metallic and carbon arc and oxy-acetylene processes are used, each having field for which it is specially suitable; other processes, such as resistance, butt and spot welding, are neither successful nor suitable means for welding cast iron; thermit welding may be used with advantage in very few cases; metallurgical and mechanical properties of cast iron; expansion and contraction; free castings; semi-rigid and rigid castings.

CASTING

Centrifugal. Centrifugal Casting of Steel, L. Cammen. Am. Soc. Steel Treat.—Trans., vol. 11, no. 6, June 1927, pp. 915-949 and (discussion) 950-958. First part deals with centrifugal tube casting; its present and prospective field of application and limitations, particularly where centrifugal tube casting comes into competition with piercing process; second part is devoted to new are of centrifugal bar casting, affecting entire steel industry; its importance lies in its ability to produce metal of better quality at cost estimated to be from $3.50 to $8.50 per ton lower than present methods; mechanical and metallurgical features of process and machinery employed.

CASTINGS

DEFECTS. What Causes Common Defects in Castings? J. W. Bolton. Foundry, vol. 55, nos. 4 and 10, May 1 and May 15, 1927, pp. 357-360 and 403-405, 16 figs. Several typical casting defects have been selected, their appearance defined, their method of formation explained and possible remedies suggested.

CEMENT

TESTS. Report of Committee C-1 on Cement. Am. Soc. Testing Matls.—Advance Paper, no. 42, for mtg. June 20-24, 1927, 9 pp. Tests of fluid cement-water mixtures.

CEMENT, PORTLAND

CANADA. Portland Cement in Canada, W. A. Toohey. Can. Min. & Met. Bul., no. 181, May 1927, pp. 561-593, 17 figs. Growth of industry in Canada; Canada Cement Co.; cement plant at Montreal; modern practice in use of cement; uses of Portland cement concrete; concrete an all-year-round material; high early strength of concrete; advantages of concrete construction.

CONSTITUENTS. The Tensile Strength of Portland Cement Constituents, J. O. Draffin. Am. Soc. Testing Matls.—Advance Paper, no. 55, for mtg. June 20-24, 1927, 9 pp., 3 figs. Method of estimating strength of Portland cement at various ages from study of variation in strengths of its three principal constituents.

HIGH-MAGNESIA. Long-Time Tests of High-Magnesia Portland Cements, P. H. Bates. Am. Soc. Testing Matls.—Advance Paper, no. 54, for mtg. June 20-24, 1927, 11 pp., 1 fig. Data obtained in testing number of cements prepared in U.S. Bureau of Standards' experimental cement plant, containing from normal to very high percentages of magnesia; ten-year strengths of concretes made from cements containing as much as 14 per cent of magnesia shows no marked disintegration.

CENTRAL STATIONS

BAYSIDE, WIS. New Bayside Station Aids Wisconsin Hydro Plants. Power Plant Eng., vol. 31, no. 11, June 1, 1927, pp. 596-604, 11 figs.

CRAWFORD AVE., CHICAGO. High Steam Pressure and Temperature at Crawford Avenue Station, A. D. Bailey. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. May 23-26, 1927, 18 pp., 7 figs.

DESIGN. Present Tendencies of Steam-Station Design, V. E. Alden. Mech. Eng., vol. 49, no. 6, June 1927, pp. 603-608.

EAST RIVER, NEW YORK CITY. The East River Generating Station of the New York Edison Company. Gen. Elec. Rev., vol. 30, no. 5, May 1927, pp. 238-260, 30 figs.

EDGAR, BOSTON. High-Pressure Steam at Edgar Station, I. E. Moultrop and E. W. Norris. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. May 23-26, 16 pp.

Pioneer Experiences at Edgar Station, G. R. Davison and R. E. Dillon. Power Plant Eng., vol. 31, no. 11, June 1, 1927, pp. 605-608, 5 figs. Majority of difficulties predicted for this pioneer high-pressure installation did not materialize.

ENGLAND. Extensions at the Deptford Power Station. Engineer, vol. 143, no. 2725, June 3, 1927, pp. 598-600, 6 figs., partly on p. 604. Capacity of plant at present installed in station is over 100,000 kw., and, to accommodate this plant, original building has been considerably extended; in new boiler house there are 14 boilers, each having capacity of 50,000 lbs. of water per hour; seven turbine driven pumps supply feed water to new boilers; there are three 4,000 kva. turbo-generator sets and one 7,500 kva. set all generating at 2,500 volts. See also Abstract in Engineering, vol. 123, no. 3202, June 3, 1927, pp. 666-668, 3 figs.

New Generating Station for the Borough of Poplar, J. H. Bowden. Engineering, vol. 123, no. 3198, Apr. 29, 1927, pp. 514-516 and 518, 4 figs. Initial steam-raising equipment consists of one double-circulation and two cross-drum boilers; flash evaporator for breaking down raw water has been installed, together with deaerator for treating all feed water passing to boilers; feed system is entirely closed.

A New Power Station at Carlisle. Engineer, vol. 143, no. 3724, May 27, 1927, pp. 573-574, 3 figs., partly on p. 578. Boiler house contains four Stirling boilers equipped with integral superheaters and underfeed self-contained stokers; turbine house contains at present one 6,000 kw. set supplied by British Thomson-Houston Co. See also Engineering, vol. 123, no. 3203, June 3, 1927, pp. 685-687, 2 figs., and Elec. Times, vol. 71, no. 1857, May 26, 1927, pp. 117-119, 5 figs.

HIGH-PRESSURE. High-Pressure Power Station Design in the Middle West, F. S. Collings. Power, vol. 65, no. 23, June 7, 1927, pp. 869-872, 6 figs. Outstanding points of interest showing why 500 to 600 lb. is most economical steam pressure for large stations, gain from reheat and air preheating, including pointers on choice of fuel-burning equipment, water vs. air-cooled furnaces, evaporators and relative merits of closed feed water system as against flash system for deaeration of boiler feed water.

SOUTH WALES. Recent Extensions at Treforest (Upper Boat) Power Station. Elec. Times, vol. 71, no. 1854, May 5, 1927, pp. 610-612, 2 figs.

CHARCOAL

FRANCE. Charcoal Resources of France (Ressources de la France en charbon de bois), M. Arnould. Annales de l'Office National des Combustibles Liquides, vol. 1, no. 3, 1926, pp. 517-521. Study of question of use of charcoal as national fuel in France.

COAL

CARBONIZATION. Coal Washing and Carbonization in the Mines of La Loire and Roche-la-Molière (Le lavage et la carbonisation de la houille aux mines de la Loire et de Roche-la-Molière), C. Berthelot. Société des Ingénieurs Civils de France—Mémoires et Comptes Rendu des Travaux, vol. 79, nos. 9-10, Sept.-Oct. 1926, pp. 792-819, 11 figs.

The Turner Low-Temperature Carbonization Plant. Engineering, vol. 123, no. 1399, May 6, 1927, pp. 559-561, 7 figs. Describes plant in operation at works of Comac Oil Co., employing system developed by C. Turner; first commercial application of his methods.

COKING. Coking (Contribution à l'étude du mécanisme de la transformation de la houille en coke). E. Audibert and L. Delmas. Chimie & Industrie, vol. 17, no. 3, Mar. 1927, pp. 355-366, 17 figs. Study, illustrated with photomicrographs, of mechanism of coking; curves are shown in which volume increase is plotted against time and against temperature; structure of coke was studied with respect to effect of time, temperature and uniformity of heating, nature of original coal being duly considered.

COMBUSTION. The Combustion of Coal (Das Verbrennen der Kohle), K. Schreber. Dinglers Polytechnisches Jl., vol. 108, no. 9, May 1, 1927, pp. 97-102, 1 fig. Results of investigation showed that coal on grate at ordinary grate temperatures burns only with aid of CO_2; only with very high temperature, such as in blast furnaces and similar works, does coal burn direct with oxygen and then only to CO.

SPECIFICATIONS. Report of Committee D-5 on Coal and Coke. Am. Soc. Testing Matls.—Advance Paper, no. 62, for mtg. June 20-24, 45 pp., 9 figs. Proposed standard definitions of terms relating to coal and coke; determination of sulphur in coal and coke by bomb-washing and sodium-peroxide fusion methods; laboratory sampling and analysis of coal and coke; methods of analysis; determination of phosphorus in ash.

COAL DUST

EXPLOSIBILITY. Explosibility of Coal Dust from Four Mines in Utah, H. P. Greenwald. U.S. Bur. Mines—Tech. Paper, no. 386, 1927, 20 pp., 2 figs. Describes methods of test and summarizes results.

INFLAMMATION. The Inflammation of Coal Dusts, T. N. Mason and R. V. Wheeler. Colliery Guardian, vol. 133, no. 3462, May 6, 1927, pp. 1047-1049, 3 figs. Effect of chemical composition of dust; experiments with dusts from number of British bituminous coals have shown that there is relationship between content of volatile matter and amount of incombustible matter which must be present in mixed coal dust and incombustible dust in order that continued propagation of flame shall not take place. Abstract of Safety in Mine Research Board Paper No. 33.

The Inflammation of Coal Dusts. Iron & Coal Trades Rev., vol. 114, no. 2088, May 6, 1927, pp. 740-741. Effect of chemical composition of coal dusts.

COAL MINES

AIR CONDITIONING. Local Air Conditioning Underground, W. Hancock. Iron & Coal Trades Rev., vol. 114, no. 3090, May 20, 1927, pp. 824-825, 4 figs. Efficiencies of small auxiliary ventilating units. Abstract of committee report presented before Inst. Min. Engrs.

COKE

FORMATION. The Formation of Coke, G. E. Foxwell. Gas World, vol. 86, no. 2235, June 4, 1927, pp. 10-14. Behaviour of coal at temperatures below 350 deg. cent.; behaviour of coal between 350 to 500 deg.; changes during plastic stage; action in plastic stage at constant temperature; surface flow; formation of pores; French views; reactions and physical changes occurring above 500 deg.

A Study of Coke Formation, R. A. Mott. Fuel, vol. 6, no. 5, May 1927, pp. 217-231, 1 fig. Theory of surface flow of solids; application of coke formation; application of experimental study.

IGNITION AND COMBUSTION. Determination of the Relative Ignitibilities and Combustibilities of Domestic Cokes: Some Tests on the Possibilities of a "Brazier and Weighing Method," T. F. E. Rhead and R. E. Jefferson. Chem. & Industry, vol. 46, no. 18, May 6, 1927, pp. 166T-172T, 12 figs. Progress of coke fire; factors influencing burning of coke in domestic grate; possibilities of weighing method have been partly investigated for differentiating between ignitibilities and combustibilities of different cokes for domestic use; loss in weight involves moisture and volatile matter as well as loss by combustion; influence of size of coke, grade, height of fire and natural draught are clearly demonstrated.

PROPERTIES. Some Properties of Coke, J. W. Cobb. Nature (Lond.), vol. 119, no. 3003, May 21, 1927, pp. 751-753. Ash constituents; reactivity in CO_2 and air; heating of coke in air; industrial and domestic applications. Substance of two lectures delivered at Royal Inst.

COMPRESSED AIR

FIXTURES. Fixtures Operated by Compressed Air. Machy. (Lond.), vol. 30, nos. 757 and 762, Apr. 14 and May 19, 1927, pp. 42-44 and 201-204, 8 figs. Apr. 14: Valve for controlling air-operated fixture; fixture for counterboring operation; air-operated chuck. May 19: Air-operated stamping press, milling fixture actuated by compressed air, and air-adjusted semi-automatic machine. See also Machy. (N.Y.), vol. 33, nos. 8 and 9, Apr. and May 1927, pp. 590-593 and 673-676, 8 figs.

CONCRETE

FIELD CONTROL. Symposium on Field Control of the Quality of Concrete. Am. Soc. Testing Matls.—Advance Paper, no. 53, for mtg. June 20-24, 1927, 72 pp., 12 figs. Contains following contributions: Introduction by Cloyd M. Chapman; Proportion of Concrete, R. W. Crum; Mixing of Concrete, D. A. Abrams; Conveying and Placing Concrete, N. L. Doe; Construction Joints and Expansion Joints, R. L. Bertin; Insuring Quality Concrete in Cold Weather; F. H. McGraw; Transverse Tests as a Criterion of the Quality of Concrete, H. S. Mattimore; Field Testing of Concrete, R. B. Young.

SPECIFICATIONS. Report of Committee C-9 on Concrete and Concrete Aggregates. Testing Matls.—Advance Paper, no. 49, for mtg. June 20-24, 1927, 59 pp., 2 figs. Design of concrete mixtures; specifications and methods of tests of aggregates; review of theories of designing concrete mixtures; conditions affecting durability of concrete; relation of compressive strength of concrete to water-cement ratio, space-cement ratio and grading of aggregate; field determination of approximate apparent specific gravity of fine aggregate; of approximate percentage of voids of in fine aggregate, and of surface moisture in fine aggregate.

CONCRETE CONSTRUCTION, REINFORCED

DOMES. Novel Dome Construction. Concrete & Constr. Eng., vol. 22, no. 5, May 1927, pp. 308-310, 2 figs. Reinforced concrete domes recently erected on Continent on system invented by Bauersfeld, of Jena firm of Zeiss, who also invented planetarium; dome at Zeiss firm's works was specially built for experimental work with planetarium; reinforcement is so designed that its weight will be equal at all points, and to achieve this object flat steel bars 2 ft. long are used; dome at Schott and Gen. Works is 131 ft. in diameter, and was built on same principle; erection of reinforcement was started at bottom by men working from scaffold pivoted from centre of dome so that it could be turned and raised as work proceeded.

SLABS. Slabs Supported Upon Four Edges, E. S. Andrews. Structural Engr., vol. 5, no. 5, May 1927, pp. 151-154, 4 figs. Calculations for reinforcement both ways; Grashof-Rankine theory; French government formula.

CONNECTING RODS

ARTICULATED. The Articulated Connecting Rod, J. Morris. Roy. Aeronautical Soc. —Jl., vol. 31, no. 196, Apr. 1927, pp. 343-344, 1 fig. Observations on papers of Fearn and Farren published in Feb. issue of Journal.

CONVERTERS

ROTARY. Rotary Converters, V. N. Friedman. So. Power Jl., vol. 45, no. 6, June 1927, pp. 42-49, 6 figs. Principle of synchronous converter, its rating and performance and application, types, characteristics, troubles; practices recommended for converter operation.

SYNCHRONOUS. Abridgment of the Synchronous Converter Theory and Calculations, T. T. Hambleton and L. V. Bewley. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 5, May 1927, pp 479-487 and (discussion) 492-493, 13 figs. Presents clear conception of internal voltages, currents, heating and armature reactions as related to physical structure of simplest converter and as related to passage of time.

CONVEYORS

TYPES. Mechanical and Continuous Handling of Diversified Products, E. J. Tournier. Indus. Mgmt. (N.Y.), vol. 73, no. 6, June 1927, pp. 328-333, 6 figs. Discusses uses of different types of conveyors in various industries.

COPPER

ANNEALING. The Annealing of Copper, N. R. Stansel. Fuels & Furnaces, vol. 5, no. 5, May 1927, pp. 615-618, 4 figs. Determination of recrystallization temperature of cold-worked metals; effect of annealing on properties of copper; use of electric furnace for annealing operation.

BISMUTH, EFFECT OF. Effect of Bismuth on Copper, D. Hanson and G. W. Ford. Inst. of Metals—Advance Paper, no. 418, for mtg. Mar. 9-10, 1927, 10 pp., 11 figs. Experiments made on copper containing up to 0.1 per cent. of bismuth, and effects of small quantities of bismuth on casting, hot- and cold-rolling, mechanical properties, electrical conductivity and microstructure of copper; experiments conform great embrittling effect of bismuth, and indicate that when more than trace of bismuth alone is present in copper, working properties, particularly cold-working properties, are seriously affected; solid solubility of bismuth in copper.

CORES

DRY-SAND. The Effects of Moisture Absorption on the Properties of Dry-Sand Cores, H. L. Campbell. Am. Foundrymen's Assn.—Advance Paper, no. 14, for mtg. June 6-10, 1927, 8 pp., 1 fig.

CORROSION

ATMOSPHERIC. Second Experimental Report to the Atmospheric Corrosion Research Committee (British Non-Ferrous Metals Research Association), W. H. J. Vernon. Faraday Soc.—Trans., vol. 23, no. 74, Apr. 1927, pp. 113-185 and (discussion) 185-204, 33 figs. Indoor exposure tests and laboratory experiments; open-air exposure tests; methods used for analysis of corrosion products.

DETECTION AND CURE. Finding and Curing Corrosion, C. E. Joos. Power, vol. 65, no. 21, May 24, 1927, pp. 768-772, 7 figs. Author tells how to go about finding out what is causing corrosion, where trouble begins and how to cure it; recirculation to prevent oxygen corrosion; use of soluble chromates prevents corrosion; use of brass piping; deaerators.

DIFFERENTIAL AERATION. Differential Aeration Corrosion Theory, W. B. Lewis and C. S. Irving. Eng. & Boiler House Rev., vol. 40, no. 11, May 1927, pp. 583-584. Water-level corrosion; factors which influence corrosion; calcium nitrate, calcium chloride, magnesium chloride, magnesium nitrate, carbonic-acid gas and oxygen are chief corrosive substances in boiler feed waters, and it is their influence and effect which have to be neutralized if corrosion is to be prevented.

CUPOLAS

TESTING CAST IRON. The Small Cupola for Testing of Castings (Le petit cubilot moderne pour les essais de fontes), A. Defer. Fonderie Moderne, vol. 21, Mar. 25, 1927, pp. 28-29, 1 fig. This small model has same general characteristics as large cupolas, action of melting occurring under same physical and mechanical condition; it has melting capacity of 400 to 500 kg. per hour; it may also be employed in bronze and aluminum foundries.

CUTTING TOOLS

CIRCULAR FORM. Circular Form Tools, J. W. Hayes. Machy. (Lond.), vol. 30, no. 756, Apr. 7, 1927, pp. 5-7, 2 figs. Presents formula and charts for calculating tools used when cutting brass.

CUTTING FORCE. New Method for Measuring the Cutting Force of Tools and Some Experimental Results, M. Okochi and M. Okosi. Soc. Mech. Engrs. (Japan)—Jl., vol. 30, no. 120, Apr. 1927, pp. 163-203, 44 figs. For measuring cutting force exerted on tools very exactly, authors have attempted to apply piezo-electricity and invented new apparatus for lathe tool, drill and milling cutter; experimental results on lathe tool; magnitudes of three components of cutting force are compared at various areas of cut; secondarily, effects of tempering, area of cut, cutting speed and cutting angle on cutting force; cutting temperature and effect of lubricant and tempering on durability of tool and smoothness of work surface.

STRENGTH. The Strength of Cutting Tools. Mech. World, vol. 81 no. 2108, May 27, 1927, pp. 375-376, 4 figs. Ordinary single-edged tools of simple form practically depend for strength on cross-section of steel; many tools and cutters of normally sufficient strength are weakened by grinding too much clearance; sharp corners and angles are fruitful causes of fracture either in hardening and tempering or when cutting commences.

CYLINDERS

HYDRAULIC. Maintaining Hydraulic Cylinders. Power Engr., vol. 22, no. 255, June 1927, pp. 226-227. Hydraulic cylinders are liable to unavoidable troubles, such as leakage and stiffness; how these may be easily remedied.

D

DAMS

DECAY IN. The Continuous Nature of Decay in Dams, W. Harvey. Engineer, vol. 143, no. 3724, May 27, 1927, pp. 568-569, 6 figs. Case of failure of masonry dam at Bouzey, in France, showed how modern dam could fail in much the same manner as one of primitive design; each type of dam has its own particular line of greatest probability of shearing, but torsion which produces bulging is common to all, and line of convex curvature may be anticipated for any special design and confirmed by tests conducted with models; all large dams, new or old, should be provided with rows of accurately leveled gun-metal plugs.

LEAKAGE STOP. Earth-Filled Dam Leakage Stopped by Grouting with Cement, W. H. Holmes. Eng. News-Rec., vol. 98, no. 22, June 2, 1927, pp. 900-901, 5 figs. Leakage through dam of Modesto irrigation district stopped by cement grout when reservoir was half full.

DIESEL ENGINES

AIRLESS-INJECTION. A.E.G.-Hesselman Airless-Injection Engine, F. Sass. Brit. Motorship, vol. 8, no. 86, May 1927, pp. 57-59, 7 figs. New type of compressorless Diesel engine has for its object utilization of heavy oil with effective combustion, and possesses number of noteworthy features of construction, resulting in effective pulverization and highly satisfactory penetration of fuel with air of combustion.

COMBUSTION CHAMBERS. Experimental Combustion Chambers Designed for High-Speed Diesel Engines, C. Kemper. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. May 23-26, 1927, 14 pp., 8 figs. Preliminary requirement for high-speed fuel-injection engine problem; analyses of cycles used in this type of engine; effect of increasing speeds on output of engines employing these cycles; requirements of combustion chambers; results of experiments using three different types; curves showing performance of engine when equipped with each of special types of chambers.

POWER GENERATION. Diesel Engines for Power Gneeration. Elec. News, vol. 36, no. 10, May 15, 1927, pp. 37-40. Construction and operating costs for various installations trend toward 2-stroke-cycle double-acting engines in larger sizes; generator output limited to 80 per cent engine rating for better and cheaper operation.

POWER PLANTS. Why the Panama Canal Bought Diesels. Power, vol. 65, no. 19, May 10, 1927, pp. 704-706, 4 figs. Reasons Diesel stand-by was preferred over steam; safety features of plant; engine dimensions; surprising test results. See also discussion in Universal Engr., vol. 45, no. 5, May 1927, pp. 17-23, 12 figs.

DURALUMIN

ANODIC OXIDATION. The Anodic Oxidation Treatment of Duralumin, W. Nelson. Aviation, vol. 22, no. 24. June 13, 1927, pp. 1288-1289 and 1315, 4 figs.

E

EDUCATION, ENGINEERING

SHOP COURSES. Shop Courses at the University of Washington, G. S. Schaller. West. Machy. World, vol. 18, no. 5, May 1927, pp. 201-203, 4 figs. It has been possible to lay out different shop divisions in logical sequence of raw-material flow from foundry to assembly floor; courses offered by department are designed to comprise practically every phase of activity included in modern metal-production plants.

ELASTICITY

PLASTICITY AND. Elasticity and Plasticity, E. G. Coker. Instn. Mech. Engrg.—Proc., no. 5, 1926, pp. 897-941, 25 figs. In field of elasticity, recent developments in science and technique of photoelasticity are considered; determination of stress distribution in elastic bodies; comparison of stress distributions in different elastic materials; theories of failures; distribution of shear stress in twisted shafts; photo-plasticity. Bibliography.

ELECTRIC LOCOMOTIVES

CLASSIFICATION AND ANALYSIS. Electric Locomotives, T. A. F. Stone. Instn. Mech. Engrs.—Proc., no. 5, 1926, pp. 1001-1016 and (discussion) 1017-1043, 4 figs. Method of classifying, analyzing and comparing their characteristics; leading characteristics of steam and electric locomotives; classification of characteristics; analysis of characteristics.

ELECTRIC MOTORS, A.C.

STANDARDIZATION. Electric Motor Standardization, R. C. Deale. Am. Mach., vol. 66, no. 24, June 16, 1927, p. 1004, 1 fig. Presents table giving list of principal dimensions of 5-h.p. squirrel-cage motors made by leading manufacturers in United States; examination will show how closely these dimensions check with one another, and will indicate what minor changes would have to be made in order to have all conform to single standard.

STARTING. Single-Phase Induction Motor Starting Device, G. Windred. Elec. Rev., vol. 100, no. 2584, June 3, 1927, pp. 874-876, 1 fig. Review of methods employed for starting single-phase induction machines; description of Ferraris-Arno method.

ELECTRIC TRANSMISSION LINES

132-KV. Changing a Transmission System to Operate at Double Voltage, W. C. Sontum. Elec. Jl., vol. 24, no. 6, June 1927, pp. 265-267, 1 fig. Tremendous advantages attend use of 132-kv. over 66-kv., as formerly used; transmission losses during present peak loads are reduced 5,000 kw.; lower line losses are attended by much improved system of voltage regulation.

60,000-VOLT UNDERGROUND. Notes on the 60,000-Volt Underground Network of the Union d'Electricité, E. Mercier. Instn. Elec. Engrs.—Jl., vol. 65, no. 365, May 1927, pp. 499-505 and (discussion) 505-516, 9 figs. Network has been successfully operated in Paris district for past four years; reasons why single-core cables were adopted for distribution system; details in regard to construction of cables, method of laying and operating conditions, both electrical and thermal.

ELECTRIC WELDING, ARC

BUILDINGS. Testing the Design Features of an Arc Welded Building, A. M. Candy. Elec. Jl., vol. 24, no. 6, June 1927, pp. 276-283, 26 figs. Tests fully demonstrate that arc-welded joints can be constructed in such manner as to develop fully ultimate strength of structural members connected; beams and girders can be connected to columns so as to produce absolute fixation, etc.

PROGRESS. Electric Arc Welding, R. E. Smythies. Eng. Jl., vol. 10, no. 5, May 1927, pp. 262-266, 8 figs. Recent progress in application; arc welding vs. riveting; arc welding in tool room; welding of alloy steels.

REPLACING CASTINGS BY. Replacing Castings by Welded Steel Parts, J. F. Lincoln. Am. Welding Soc.—Jl., vol. 6, no. 4, Apr. 1927, pp. 33-41, 7 figs. Considers problems involved.

STRUCTURAL. Modern Structural Industry Demands a Knowledge of Arc-Welding, C. J. Holslag. Am. Welding Soc.—Jl., vol. 6, no. 4, Apr. 1927, pp. 82-88, 4 figs. Deals primarily with arc welding structural work.

ELECTRIC WELDING, RESISTANCE

SEAMS. Resistance Line Welding, H. W. Tobey. Am. Welding Soc.—Jl., vol. 6, no. 4, Apr. 1927, pp. 74-81, 7 figs.

ELECTRICAL MACHINERY

SPRING MOUNTING. Spring Mounting Reduces Vibration in Single-Phase Machinery, G. W. Penney. Power, vol. 65, no. 24, June 14, 1927, pp. 914-916, 4 figs. On account of pulsating torque developed by single-phase machines they have tendency to vibrate and cause trouble in building that houses them and in adjacent structures; successful method has been developed for preventing these vibrations by mounting machine's stator on springs.

VIBRATIONS. Vibration of Frames of Electrical Machines, J. P. DenHartog. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. May 23-26, 1927, 15 pp., 9 figs. In connection with attempts to reduce noise of electrical machinery in general, and more especially of small motors for domestic use, it is of importance to be able to calculate natural frequency of vibration; it is shown that frame, which usually emits large portion of total noise, can, in many cases, be regarded as part of ring with rigid ends; formulas and curves are given for calculation of this fundamental frequency.

ELECTRICITY SUPPLY

ENGLAND. Thornton and Cleveleys' Electricity Scheme. Engineer, vol. 143, no. 3725, June 3, 1927, pp. 608-610, 8 figs. These two health resorts have been provided with supply which serves for lighting number of modern houses by means of underground cables.

FORECASTING UTILITY GROWTH. Forecasting Utility Growth, L. W. W. Morrow. Elec. World, vol. 89, no. 23, June 4, 1927, pp. 1185-1191, 7 figs. Steps in development of plan for building light and power system on basis of balance in engineering, commercial, financial and operating requirements.

ISOLATED LOAD. Serving the Isolated Load, M. H. Hobbs. Elec. Jl., vol. 24, no. 6, June 1927, pp. 258-264, 15 figs. Simple forms of circuit protection; methods of tripping; automatic reclosing circuit breakers; metering equipment; types of switch houses; utilization of switch houses.

ELECTROPLATING

Ferroxyl Test. A Rapid and Practical Method of Applying the Ferroxyl Test to Protective Coatings, K. Pitschner. Am. Soc. Testing Matls.—Advance Paper, no. 38, for mtg. June 20-24, 1927, 6 pp., 3 figs. "Ferroxyl" test for determining presence of pinholes in plated coatings has been in use for long time, but up to present has been laboratory rather than shop test; search for more practical mode of handling led author to development of test paper embodying reagent by means of which it is possible to make permanent record in two or three minutes; reagent has been developd so that it will detect pinholes through nickel or chromium to copper as indicated by brownish red spots.

ELEVATORS

High-Speed. Electric Elevator Practice, E. M. Bouton. Elec. Jl., vol. 24, no. 6, June 1927, pp. 299-302, 5 figs. High-speed elevator developments.

EMPLOYEES

Selection and Placing. Vocational Guidance in Business, D. Fryer. Indus. Mgmt. (N.Y.), vol. 73, no. 6, June 1927, pp. 366-371. Practical application of psychology to selection and placing of employees.

ENGINEERING

Ancient Methods. Ancient Methods of Engineering, A. Sanborn. Tech. Eng. News, vol. 8, no. 3, Apr. 1927, pp. 118-119 and 150, 2 figs. Engineering features used in construction of Pyramids.

Consulting. Consulting Engineering as a Profession, D. C. Jackson. Purdue Eng. Rev., vol. 22, no. 4, May 1927, pp. 7-9. Importance of engineer to modern economic system; opportunities in future of consulting engineering practice.

EXHAUST STEAM

Pressure-Raising Apparatus. A Steam-Pressure Transformer, L. S. Marks. Mech. Eng., vol. 49, no. 6, June 1927, pp. 600-602, 4 figs. Analysis of Koenemann's recently devised process for raising pressure of exhaust steam, and comparison showing its apparent advantages over mechanical method employing centrifugal compressor.

EXPLOSIONS

Gaseous. The Initial Stages of Gaseous Explosions, W. A. Bone, R. P. Fraser and D. A. Winter. Roy. Soc.—Proc., vol. 114, no. A768, Apr 1, 1927, pp. 402-449. Part I—Flame speeds during initial uniform movement; Part II—Examination of the supposed law of flame speeds; Part III—Behaviour of an equimolecular methane-oxygen mixture when fired with sparks of varying intensities.

EXPLOSIVES

Liquid Oxygen. Liquid Oxygen Speeds and Cheaper Stripping, G. B. Holderer. Coal Age, vol. 31, no. 14, Apr. 7, 1927, pp. 497-501, 4 figs. Thorough shooting of overburden so lightens work of shovels that their dippers have been enlarged and they are now crowding drills. Abstract of paper presented before Am. Inst. of Min. & Met. Engrs. See also discussion by J. Barat in no. 20, May 19, 1927, pp. 726-727, on whether L.O.X. is as efficient as it is claimed to be.

Coal Mines. Suitability of Various Explosives for Coal Mines, J. E. Tiffany. Min. Congress Jl., vol. 13, no. 5, May 1927, pp. 353-356, 3 figs. Black powder still leads permissible explosives in consumption; coal dust is inevitable in bituminous coal mines; hazards of various explosives classified and recommended practice outlined. Published with approval of Bur. of Mines.

F

FATIGUE

Industrial. Better Utilization of Human Effort and Industrial Fatigue (Le Meilleure utilisation de l'effort humain et la fatigue industrielle), L. A. Legros. Société des Ingénieurs Civils de France—Mémoires et Compte Rendu des Travaux, vol. 79, nos. 9-10, Sept.-Oct. 1926, pp. 915-952, 2 figs. Points out that workers should know as much as possible concerning their particular task, and results of discoveries should be made known to them; deals with theories of Taylor and Gilbreth; gives list of research work which might be usefully applied.

FEED WATER HEATERS

Exhaust-Steam Injectors. The Exhaust-Steam Injector. Ry. Gaz., vol. 46, no. 18, May 6, 1927, pp. 591-592. While live steam injector is universally admitted to be simplest boiler feeder for locomotives, it is not generally realized that exhaust injector is now equally as simple and reliable in working; velocity of exhaust-steam; theory of design and economies in working; comparative tests.

Locomotives. Locomotive Feed Water Heating, W. C. Hamm. Eng. Jl., vol. 10, no. 6, June 1927, pp. 302-308, 16 figs. Its application and advantages, economies effected under operating conditions and description of various types of heaters in use.

FERRO-MANGANESE

Blast-Furnace Production. Ferro-Manganese Production in Blast Furnaces, W. McConnachie. Iron & Coal Trades Rev., vol. 114, no. 3087, Apr. 29, 1927, p. 675. Effect of alkalies.

FILTRATION PLANTS

Denver, Colo. The Denver Filter Plant, J. H. Fuertes. Am. Water Wks. Assn.—Jl., vol. 17, no. 5, May 1927, pp. 538-552, 3 figs. New 64,000,000-gallon Marston lake water-purification plant; process is that of rapid filtration preceded by screening, aeration, coagulation and accompanied by sterilization.

FLOTATION

Reagents and Practice. Flotation Reagents and Practice, H. S. Gieser. Eng. & Min. Jl., vol. 123, no. 20, May 14, 1927, pp. 842-846. Review showing how selective separation of minerals is being accomplished.

FLOW OF AIR

Measurement. A Precision Method of Measuring Air Flow, J. A. Polson. Illinois Engr., vol. 3, no. 5, May 1927, pp. 1-2. In method described, provision has been made for obtaining extreme accuracy in determining rate of flow of air in pounds per second or per minute; this is accomplished by actually weighing air in storage tank before and after test run; it can be used for very small rates of air flow, and when pressure on inlet side of orifice is above as well as when it is below atmospheric pressure.

FORESTRY

Quebec. Discussion of Paper on Notes on the Forests of Quebec, G. C. Piche. Eng. Jl., vol. 10, no. 5, May 1927, pp. 273-276.

FORGING

Aluminum Alloys. The Forging of Aluminum Alloys, J. Strauss. Forging—Stamping—Heat Treating, vol. 13, no. 5, May 1927, pp. 162-169, 4 figs. Methods for melting, forging and heat-treating alloys of aluminum; preparation of ingots; properties of alloys; alloys of copper. Bibliography.

FOUNDATIONS

Power Stations. Foundation Problems in the Construction of Power Stations and Substations in New York City, E. M. Van Norden. Brooklyn Engrs'. Club—Proc., vol. 25, Apr. 1927, pp. 18-27. General conditions of New York soil; regulations of New York Building Department; determination of subsurface conditions; waterfront foundations for power stations; inland foundations; research work in foundation design.

FOUNDING

Science in. The Role of Science in Founding (Le role de la science en fonderie), Rabozée. Fonderie Moderne, vol. 21, Apr. 25, 1927, pp. 73-78, 14 figs. Mechanical tests; research; chemical and thermal analysis; metallography; it is author's opinion that progress can only be effected by co-operation between industry and science.

FOUNDRIES

Materials Handling. Handling Foundry Sand and Coke. Iron Age, vol. 119, no. 23, June 9, 1927, pp. 1660-1661, 5 figs. Plant of Maytag Washing Machine Co. has several unusual arrangements designed for minimum of interference; conveyor system unusually complete. See also article in no. 24, June 16, pp. 1738-1740, 6 figs., on Conveyors and Tempering Arrangements for Foundry Sand Mixing.

FUELS

Hog. Steam Generation with Hog Fuel, O. L. LeFever. Elec. Light & Power, vol. 5, no. 6, June 1927, pp. 117-119, 5 figs. Use of so-called "hog fuel" for steam generation as practised in States of Oregon and Washington.

Research. The Fuel Research Station, C. H. Lander. Indus. Chemist, vol. 3, no. 27, Apr. 1927, pp. 162-171, 14 figs. Review of work carried out at Greenwich; survey of coal seams; high-temperature and low-temperature carbonization; hydrogenation of coal.

G

GARBAGE DISPOSAL

Fort Dodge, Iowa. Garbage and Refuse Disposal at Fort Dodge, Iowa, B. Bird. Water Wks., vol. 66, no. 6, June 1927, pp. 235-239, 10 figs. How Middle-Western city of 25,000 population solved its waste-disposal problem.

GAS CLEANING

Ferric Hydroxide for. The Use of Ferric Hydroxide as a Purifying Agent, N. H. Humphrys. Gas Engr., vol. 43, no. 613, May 1927, pp. 110-111. Extensive practical acquaintance covering many varieties, including both natural and artificial, has shown that systematic working and observance of few simple precautions will place oxide purification amongst most reliable and least troublesome of gas-works operations.

GAS TURBINES

Nozzles. The Proportioning of Nozzles for Explosion Turbines, E. C. Wadlow. Engineer, vol. 143, no. 3725, June 3, 1927, pp. 600-602, 5 figs. Presents views of several authorities in order to obtain some idea of position up to date and what further work is necessary before satisfactory compromise is found.

GASES

Combustion. Gaseous Combustion at High Pressures, W. A. Bone. Roy. Soc.—Proc., vol. 115, no. A770, June 1, 1927, pp. 41-58, 5 figs. Spectographic investigation of ultra-violet radiation from carbonic oxide-oxygen (or air) explosions.

Ignition Point. On the Ignition-Point of Gases at Different Pressures, H. B. Dixon and W. F. Higgins. Manchester Literary & Philosophical Soc.—Memoirs & Proc., vol. 70, no. 1, 1925-26, pp. 29-36. Preliminary account of experiments, made on behalf of Safety in Mines Research Board, on ignition points of gases in new form of concentric-tube apparatus designed to work under pressure above or below that of atmosphere.

GEAR MANUFACTURE

Industrial Benefits. Development of Gear Making a Benefit to Entire Machinery Industry, Frost. Am. Mach., vol. 66, no. 21, May 26, 1927, p. 918d. To-day there is insistence for better steels and other materials used in gears, and new alloys are continually being developed along with new methods of surface hardening to meet this demand; greater tensile strength and resistance to wear and fatigue are constantly sought. Presidential address to Am. Gar Mfrs'. Assn.

GEAR CUTTING

Cutter Manufacture. Manufacturing Cutters for Gear Generators. Machy. (Lond.), vol. 30, no. 756, Apr. 7, 1927, pp. 10-12, 5 figs. Milling and grinding operations on cutters for Gleason machines.

Planers. Sunderland Gear-Planing Machine. Engineering, vol. 123, no. 3203, June 3, 1927, pp. 670-672, 9 figs. partly on p. 674. Design for cutting double helical gears up to 10 ft. in diameter and 24 in. face, with attachments for cutting spur gears with two cutters, and also for cutting spur and spiral gears with single cutter.

GEARS

Developments. Gear Design and Manufacture, 1877 and 1927, E. Buckingham. Am. Mach., vol. 66, no. 20, May 19, 1927, pp. 866-867. Major advance in this art during past fifty years has been refinement of manufacturing processes and product.

Testing. Involute Gear Tester. Machy. (Lond.), vol. 29, no. 755, Mar. 31, 1927, pp. 838-839, 4 figs. Zeiss tester is designed for accurate testing of involute profile curve of gear teeth; instrument will accommodate all spur gears with involute teeth up to 16-in. diameter; it is also possible to determine base diameter of gear if this is not known, it being only necessary to find diameter which gives smallest deviation.

Tooth Loads. The Influence of Elasticity on Gear-Tooth Loads. Mech. Eng., vol. 49, no. 6, June 1927, pp. 644-649, 6 figs. Progress report no. 4 or A.S.M.E. special research committee on strength of gear teeth; perfect gears; static deformation of gear teeth; variation in load caused by static deformation; elasticity form factor. See abstract in Am. Mach., vol. 66, no. 21, May 26, 1927, p. 899.

Worm. Worm Gearing—Reply, H. E. Merritt. Machy. (Lond.), vol. 29, no. 753, Mar. 17, 1927, pp. 779-780. Under ordinary conditions of manufacture, worm with too small pressure angle, that is, with area of zero pressure angle inside projected area of wheel rim, may give rise to manufacturing difficulties, which can easily be avoided without sacrificing any desirable quality in finished gear by eliminating area of negative pressure angle. Reply to E. A. Limming's criticism of author's series of articles in previous issues of this journal.

GOLD MINING

Ontario. Mining Methods of Porcupine Gold Area, G. C. Cole. Can. Min. Jl., vol. 48, nos. 18 and 19, May 6 and 13, 1927, pp. 367-369 and 390-392. Diamond drilling, sampling, stoping, sand filling of stopes, hoisting, underground haulage; ventilation.

Mining Practice in Kirkland Lake Gold Area, J. G. McMillan. Can. Min. Jl., vol. 48, no. 19, May 13, 1927, pp. 386-389. Drifts and shafts; drilling, blasting, timbering, stoping, haulage and hoisting; pumping.

GYPSUM

SPECIFICATIONS. Report of Committee C-11 on Gypsum. Am. Soc. Testing Matls.—Advance Paper, no. 51, for mtg. June 20-24, 1927, 2 pp. Standard methods of testing gypsum and gypsum products; specifications for gypsum plasters; tentative definitions of terms relating to gypsum industry.

H

HEAT

REFLECTION BY METAL SURFACE. Reflection of Heat Ray by Metal Surface, M. Oyama and Z. Hikasa. Inst. Elec. Engrs. of Japan—Jl., no. 465, Apr. 1927, pp. 345-351, 8 figs. Investigation of reflection of heat ray by surfaces of brass, copper and aluminum, using as heat-ray source total radiation of nichrome heat element and thermopile as detector; reflection from rough surfaces; surfaces polished by sand paper and frosted glass were investigated. (In Japanese.)

HEAT TRANSMISSION

BUILDING WALLS. Graphic Method for Determining Heat-Transmission Coefficients Through Building Walls (Méthode graphique pour déterminer les coefficients de transmission de chaleur à travers les parois des bâtiments). R. Meisterhans. Chaleur & Industrie, vol. 8, no. 80, May 1927, pp. 269-274, 7 figs. Graphic methods which permit rapid and accurate determination of heat-transmission coefficient for any type of construction, adhering strictly to mathematical character.

HEATING

OIL CIRCULATION. Industrial Heating by Oil Circulation, A. B. McKechnie. Indus. & Eng. Chem., vol. 19, no. 6, June 1927, pp. 691-693, 2 figs. Heat transmission by hot oil embodies desirable features and eliminates objections of other methods for obtaining high temperatures; quantity of heat delivered is under control at all times, and product temperatures up to 555 deg. Fahr. are reached without difficulty; design of system; applications.

HIGHWAYS

MAINTENANCE BY CONTRACT. Reconstruction and Maintenance by Contract, G. F. Schlesinger. Roads & Streets, vol. 67, no. 5, May 1927, pp. 223-226. Discussion on possibilities of handling this work by contract. Address to Associated General Contractors of America.

HINGES

HEAVY. Heavy Hinges, A. Rutherford. Machy. (Lond.), vol. 29, no. 755, Mar. 31, 1927, pp. 849-850, 1 fig. Deals with friction of hinge bearings.

HOISTS

BRAKES. Safety Hoist Brake of New Type Has Many Advantages, C. H. S. Tupholme. Coal Age, vol. 31, no. 20, May 19, 1927, pp. 729-731, 2 figs. Free-fall brake eliminates braking-pressure shocks.

HYDRAULIC TURBINES

SWEDEN. Lilla Edet Station Has Two Types of Waterwheels, G. Willock. Power, vol. 65, no. 23, June 7, 1927, pp. 866-868, 9 figs. Three waterwheels of 11,200-h.p. rating operate under 21-ft. head; all these wheels are of propeller type, one having adjustable blades and two stationary blades; this combination gives an efficiency of 90 per cent from about 3,000 to 32,000 h.p. load.

KAPLAN. The Official Tests of the Kaplan Turbine at Lilla Edet, H. O. Dahl. Engineering, vol. 123, no. 3201, May 20, 1927, pp. 599-602, 9 figs.

TESTING. Tailrace Used to Obtain Test Load on Hydro-Electric Unit, C. R. Reid. Power, vol. 65, no. 24, June 14, 1927, p. 919, 2 figs. Method employed for tests at different speeds on 30,000-h.p. waterwheel which was direct-connected to 25,000-kva., 60-cycle generator; advantages of arrangement over usual water-box or rheostat directly connected to generator are that it is less expensive, more quickly installed and more reliable in operation.

HYDRO-ELECTRIC DEVELOPMENTS

SCOTLAND. The Lochaber Hydro-Electric Scheme, Scotland. Water & Water Eng., vol. 24, no. 341, May 20, 1927, pp. 177-179, 3 figs. Particulars of scheme undertaken by British Aluminum Co.

HYDRO-ELECTRIC PLANTS

AUTOMATIC. Automatic Power Stations, H. Puppikofer. Brown Boveri Rev., vol. 14, no. 5, May 1927, pp. 124-128, 3 figs. Brown, Boveri & Co. have developed remote control and signalling system which possesses great advantage over systems widely used in America, as it enables all instruments to be read at control point.

CALIFORNIA. Kings River Plant Added to Central California Power System, J. W. Jourdan. Elec. West, vol. 58, no. 5, May 1927, pp. 253-260, 11 figs. 33,000-kva. Balch plant of San Joaquin Light & Power Corp.; roads and construction camps; diversion dam and intake; pressure tunnels; penstock; hydraulic equipment; electrical apparatus; Afterbay dam.

MODEL EXPERIMENTS. Experiments with Hydraulic Models for the City of Zürich's Wettingen Plant (Die hydraulischen Modellversuche für das Limmatkraftwerk Wettingen der Stadt Zürich). E. Meyer-Peter. Schweizerische Bauzeitung, vol. 89, nos. 21 and 22, May 21 and 28, 1927, pp. 275-279 and 291-297, 27 figs. Experimental study of profile for weir 20.5 mi. high, also of spillway, outlets, etc., for maximum discharge of 750 cu. mi. per sec.; special investigations.

QUEBEC. More Power in the Laurentian District, W. Evans. Contract Rec., vol. 41, no. 19, May 11, 1927, pp. 451-453, 4 figs. East branch development No. 1 at Mont Rolland, one of series of hydro-electric plants of Quebec Southern Power Corp.

I

INDUSTRIAL MANAGEMENT

BUDGETING. Improving Unit Costs Through the Budget, J. H. Barber. Mfg. Industries, vol. 13, no. 6, June 1927, pp. 447-450, 1 fig. Proposed reduction of 3.3 per cent in total cost was made up of 4.4 per cent in piece-rate labour, 5 per cent in indirect payroll; such a programme controls production and assures profits.

INVENTORY CONTROL. Cost Cutting in Inventories and Accounts, L. C. Kunz. Mfg. Industries, vol. 13, no. 6, June 1927, pp. 429-432, 3 figs. Waste reduced, stocks cut down, manufacturing cost lowered and profits increased by system of inventory control and cost accounting that checks up monthly with surprising degree of accuracy; method employed by Moto-Meter Co.

PRINTED FORMS. Planning for Better Forms, A. J. Zimmerman. Am. Mach., vol. 66, no. 22, June 2, 1927, pp. 919-920, 2 figs. Designing of forms to provide for simplicity and economy is consideration of primary importance, and has vital bearing on efficiency with which routine of business is carried on.

STATISTICAL REPORTS. A Practical Method for Analyzing Business Conditions, J. B. Waterfield. Indus. Mgmt. (N.Y.), vol. 73, no. 6, June 1927, pp. 337-338, 2 figs. Statistical reports contain interesting information if properly studied; suggested form for keeping track of business conditions.

TAYLOR SYSTEM. Has Taylorism Survived? D. S. Kimball. Mech. Eng., vol. 49, no. 6, June 1927, pp. 593-594. Points out that Taylor's paper, Shop Management, still remains basic statement of new industrial philosophy.

INDUSTRIAL PLANTS

BUILDING MAINTENANCE. Maintenance and the Industrial Building, W. G. Ziegler. Indus. Mgmt. (N.Y.), vol. 73, no. 6, June 1927, pp. 351-354. Suggestions for keeping buildings and other plant facilities in good condition.

LOCATION. Plant-Location Factors of Western Electric Co., Kearny Works, O. C. Spurling. Mech. Eng., vol. 49, no. 6, June 1927, p. 697. Advantages and disadvantages of city location; advantages of Kearny site.

Reducing Freight by Plant Location, H. S. Colburn. Mfg. Industries, vol. 13, no. 6, June 1927, pp. 437-440, 5 figs. Author indicates where plants should be located with reference to supplies of raw materials and distribution of finished goods.

INSULATING MATERIALS, ELECTRIC

SPECIFICATIONS. Report of Committee D-9 on Electrical Insulating Materials. Am. Soc. Testing Matls.—Advance Paper, no. 65, for mtg. June 20-24, 1927, 26 pp., 7 figs. Existing and tentative standards; proposed revised tentative methods of testing electrical insulating materials for power factor and dielectric constant at frequencies of 100 to 1,500 kilocycles.

INTERNAL-COMBUSTION ENGINES

DETONATION. Detonation, W. A. Whatmough. Automobile Engr., vol. 17, nos. 225, 226, 227 and 228, Feb., Mar., Apr. and May 1927, pp. 55-58, 88-91, 146-147 and 170-173, 7 figs. Secret of "detonation" within meaning of term as applied to internal-combustion engines lies in uneven distribution of various factors which determine chemical combustion; such combustion comprises three distinct stages: initiation, propagation and completion of combustion; flame characteristics; liquid fuels and characteristics of combustible mixtures therefrom; engine characteristics; consideration of detonation theories. Mar.: Detonation standards; factors; components of motor fuels. Apr.: Mean volatility and mixture stability; vaporization of fuel; saturation temperatures or fog points. May: Practical considerations.

THERMODYNAMIC ANALYSIS OF CYCLES. A Thermodynamic Analysis of Internal-Combustion Engine Cycles, G. A. Goodenough and J. B. Baker. Univ. of Ill.—Bul., vol. 24, no. 21, Jan. 25, 1927, 67 pp., 24 figs.

VARIABLE COMPRESSION. Internal-Combustion Engine with Variable Compression. Engineering, vol. 123, no. 3202, May 27, 1927, pp. 638-639, 5 figs. Designed by Ricardo & Co.; testing set was made up of complete unit with electric cradle dynamometer.

IRON

INDUSTRIAL APPLICATION. Pure Iron in Its Industrial Applications, L. P. Sidney. Iron & Steel Industry & Brit. Foundryman, vol. 1, no. 2, May 6, 1927, pp. 41-43. Homogeneity and corrosion; commercially pure iron; ingot iron; importance of homogeneous base in tinning, galvanizing and enamelling; reliability of homogeneous material.

IRON AND STEEL

TESTING. Making and Heat-Treating Iron and Steel, R. Job. Can. Machy., vol. 37, no. 20, May 19, 1927, pp. 20-21. Outlines manner in which testing of iron and steel is carried out and importance of tests to industry.

IRON ALLOYS

IRON MANGANESE. Thermal Changes in Iron-Manganese Alloys, Low in Carbon, R. Hadfield. Roy. Soc.—Proc., vol. 115, no. A770, June 1, 1927, pp. 120-132. As result of research, author has found that low-carbon alloys described when heat treated and quenched do not possess remarkable combination of tenacity and ductility displayed by manganese steel in anything like same degree.

IRON CASTINGS

DEFECTIVE. Analysis of Four Hundred Tons of Defective Castings, J. M. Haley. Am. Foundrymen's Assn.—Advance Paper, no. 2, for mtg. June 6-10, 1927, 10 pp., 2 figs. Study of conditions in grey-iron foundry, average production of which approximates 80 tons per day; analysis of defective castings, which varied in weight from 4 ounces to 6,000 lbs.; defects are classified and methods of controlling future production with elimination of these defects discussed.

IRON ORE

RESERVES. Available Ore Supply is Limited D. E. Woodbridge. Iron Age, vol. 119, no. 23, June 9, 1927, pp. 1658-1659 and 1720. Large part of world reserves of iron is not commercial, owing to transportation costs, expense of mining and chemical or physical composition.

IRRIGATION

SOIL MOISTURE AND PLANT GROWTH. Irrigation in Relation to Soil Moisture and Plant Growth, F. J. Veihmeyer. Agric. Eng., vol. 8, no. 5, May 1927, pp. 109-111, 4 figs. Study of behaviour of soil moisture as regards its movement in soil due to capillarity, evaporation from exposed soil surfaces and reaction of certain plants to different amounts of soil moisture under California conditions.

L

LATHES

RATE-FIXING CHARTS. Line Charts for Rate-Fixing on Lathes, Cotan. Machy. (Lond.), vol. 30, no. 756, Apr. 7, 1927 pp. 17-18, 3 figs. Presents charts which are likely to prove very useful to rate fixers generally.

TURRET. Turret Lathes in Railroad Shops, A. C. Cook. Ry. Mech. Engr., vol. 101, no. 6, June 1927, pp. 345-348, 12 figs. Suitable for quantity and small lot production; different types of machines and work turned out on them.

LEAD

CATALYTIC ACTIVITY. Catalytic Activity of Lead, F. A. Madenwald, C. O. Henke and O. W. Brown. Jl. of Phys. Chem., vol. 31, no. 6, June 1927, pp. 862-866. Results of extensive study of behaviour of lead catalysts made from carefully purified materials.

LEAD ALLOYS

LEAD-TIN. Note on the Crystallization of the Lead-Tin Eutectic, F. Hargreaves. Inst. of Metals—Advance Paper, no. 422, for mtg. Mar. 9-10, 1927, 2 pp., 3 figs. Straining and etching methods applied to 30-lb. ingot of lead-tin eutectic show exterior to possess largest crystal size with absence of distinct colonies; middle consists of much smaller crystal units in form of distinct colonies of coarser eutectic structure.

LIME

SPECIFICATIONS. Report of Committee C-7 on Lime. Am. Soc. Testing Matls.—Advance Paper, no. 47, for mtg. June 20-24, 1927, 8 pp. Standard specifications for quicklime and hydrated lime for use in cooking of rags for manufacture of paper; tentative specifications for quicklime and for hydrated lime for use in water treatment; methods of tests; proposed tentative specifications for sand for use in lime plaster and lime stucco.

LOCOMOTIVE BOILERS

HIGH-STEAM PRESSURES. High Steam Pressures in Locomotive Cylinders, L. H. Fry. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. May 23-26, 1927, 14 pp., 7 figs. Survey of efficiencies obtainable with various steam pressures; effect of ratio of expansion on efficiency.

SCALE REMOVAL. The Best and Most Economical Method of Scaling the Inside of Boiler when Flues and Tubes Are Removed. Boiler Maker, vol. 27, no. 5, May 1927, pp. 133-134. On Northern Pacific at Brainerd, Minn., scaling hammer and tools specially designed for scaling boilers are used. Abstract of paper read before Master Boiler Makers' Assn.

LOCOMOTIVES

DIESEL ENGINED. Diesel Locomotives. Ry. Age, vol. 82, no. 25, May 21, 1927, pp. 1514-1515. Information regarding European locomotives; Diesel locomotives in United States. Abstract of Committee report before Am. Ry. Assn.

LUBRICATING OILS

INTERNAL-COMBUSTION ENGINES. Engine Service Tests of Internal-Combustion Engine Lublicating Oils Made from California Crude Petroleum, M. J. Gavin and G. Wade. U.S. Bur. Mines—Tech. Paper, no. 387, 57 pp., 9 figs. Engine tests to determine relative merits of Western oils that do and do not pass acidity and emulsion tests as set forth in Technical Paper 305, Bureau of Mines, for class C oils.

PRODUCTION FROM COAL. The Production of Lubricating Oil from Coal. Engineering, vol. 123, no. 3203, June 3, 1927, pp. 665-666, 11 figs. Results of tests carried out by National Physical Laboratory on lubricating oil produced by L. & N. process of coal distillation.

LUBRICATION

GEARS. Lubrication of Power Transmission and Speed Reduction Mechanisms. Lubrication, vol. 13, no. 4, Apr. 1927, pp. 37-48, 19 figs. Gear lubrication; spur-type gears; spiral, helical or herringbone type; bevel and angular gears; annular and worm reduction gears; selection of gear lubricants; chain-drive lubrication; factors governing chain lubrication; belt and rope drives.

LUBRICANTS

LOW-SPEED BEARINGS. Lubricants for Low-Speed Bearings, A. Seton. Machy. (Lond.), vol. 30, no. 763, May 26, 1927, pp. 250-252, 1 fig. Graphite and graphitic lubricants; metallic soaps; greases; coolers for bearings.

M

MACHINE SHOPS

MOTION-TIME ANALYSIS. More Production from Motion-Time Analysis of Work, A. B. Segur. Mfg. Industries, vol. 13, no. 6, June 1927, pp. 445-446. Gives example which shows possibilities of cost cutting; motion tests for applicants.

MACHINE TOOLS

COMBINATION. Combination Machine Tool. Engineer, vol. 143, no. 3724, May 27, 1927, pp. 583-584, 3 figs. Machine tool was exhibited by Czecho-Slovakian firm, which is combination machine designed to fulfil functions of lathe, milling, shaping and drilling machines.

MAINTENANCE. The Economics of Machine Tool Maintenance, W. Ichler. Ry. Mech. Engr., vol. 101, no. 6, June 1927, pp. 331-334, 4 figs. Individual machine-tool repair cost and service record an accurate guide in determining repair or replacement policies.

MATERIALS FOR. Selection of Materials. Times Trade & Eng. Supp., vol. 20, no. 463, May 21, 1927, p. 231. Deals with metals for beds, frames and columns; spindles and bearings; gears and chucks.

PROGRESS. Machine Tool Progress in the Twentieth Century, J. E. Gleason. Am. Mach., vol. 66, no. 21, May 26, 1927, pp. 885-886. Extracts from president's address to Nat. Machine Tool Builders' Assn.

MAGNETOS

HIGH-TENSION. The High-Tension Magneto, A. P. Young and L. Griffiths. Automobile Engr., vol. 17, no. 228, May 1927, pp. 188-194, 14 figs. High-tension magneto; post-war developments; trend of design to meet post-war conditions; rotating-armature magneto; polar-inductor magneto; rotating-magnet magneto; simplification of design and operation; contact materials; magnet steels; insulating materials used in condensers; dual systems of ignition.

MALLEABLE CASTINGS

SPECIFICATIONS. Report of Committee A-7 on Malleable Castings, W. P. Putnam. Am. Soc. Testing Materials—Advance Paper, no. 14 for mtg. June 20-24, 1927, 1 p.

MEASUREMENTS

FACTORIES. Measurement and Management, W. F. Watson. Indus. Mgmt. (Lond.), vol. 14, no. 5, May 1927, pp. 175-176. Views on system of measurement prevailing in many works; points out complexities of English system of measurement; peculiarities of threads; first essential is to establish definite and immutable standard of measurement which all manufacturers should be compelled to adopt.

MEASURING INSTRUMENTS

POWER PLANTS. Measuring with the Barometer and Manometer, S. A. Curry. Power Plant Eng., vol. 31, no. 11, June 1, 1927, pp. 636-638, 2 figs. Manipulation of instruments, principle of capillarity, formation of meniscus and necessary precautions.

RAPID-REVERSING. Quick-Reversing Mechanism or Wire Coiling, P. Gates. Machy. (N.Y.), vol. 33 no. 10, June 1927, pp. 735-736. Embodied in machine for winding coils having number of layers one upon other, as used in electrical trade.

MERCURY-VAPOUR PROCESS

HARTFORD, CONN., PLANT. The Mercury-Vapour Power Plant at Hartford. Power, vol. 65, no. 22, May 31, 1927, pp. 818-819, 2 figs. Equipment comprises mercury boiler, fired with pulverized coal, mercury-vapour superheater, mercury economizer, combustion-air preheater, mercury-vapour turbine, heat exchanger that is at once mercury condenser and steam boiler, and steam superheater through which steam passes to steam plant in connection with which this mercury unit operates.

METAL WORKING

SHEARING. What Happens in Shearing Metal, E. V. Crane. Machy. (N.Y.), vol. 33, no. 9, May 1927, pp. 641-647, 16 figs. Analysis of action of metal in shearing, blanking or punching; factors affecting pressures required and results obtained.

STAMPINGS. Designing Stampings or Die-Made Parts, J. K. Olsen. Machy. (N.Y.), vol. 33, no. 9, May 1927, pp. 681-684, 7 figs. Direction of grain stock; length of material for forming lugs; hub embossing and clinched lug fastenings.

METALS

EXTRUSION. Metal Extrusion Presses. Mech. World, vol. 81, no. 2107, May 20, 1927, pp. 353-354, 1 fig. Method of operating extrusion presses; type of press commonly used for extruding brass, copper and bronze; inverted process.

METALLURGY

INDUSTRIAL APPLICATIONS. Some Recent Services of Metallurgy to Engineering, H. C. H. Carpenter. Engineering, vol. 123, nos. 3199 and 3201, May 6 and 20, 1927, pp. 555-556 and 625-626. Consideration of world's production of six principal metals used in engineering practice; ore treatment; flotation; manufacture of steel in electric furnace. James Forrest Lecture delivered before Instn. of Civil Engrs.

MICROMETERS

ACCURACY. Micrometer Accuracy, H.T.U.R. Indus. Mgmt. (Lond.), vol. 14, no. 5, May 1927, pp. 187-188. Inaccuracy of micrometers is due to faulty pitch of screw; setting micrometers.

MICROSCOPES

METALLURGICAL. The Metallurgical Microscope, G. Pirk. Gen. Elec. Rev., vol. 30, no. 5, May 1927, pp. 264-273, 14 figs. Effect of object structure on light waves; limits of resolving power; achromats and apochramats; oculars or eyepieces; illumination and illuminants; plane glass vs. prism illuminator.

MINERAL RESOURCES

CANADA. The Range of Canada's Mineral Wealth, C. Camsell. Can. Min. Jl., vol. 48 no. 22, June 3, 1927, pp. 448-450. Progress of mining development; highly mineralized Pacific belt; mineral resources of Maritime region; Great Plains as mineral region; progress in metallurgy and mineral manufacture; mining investment and employment; Canada's future as mining country.

MINES

ELECTRICAL EQUIPMENT. Questions and Answers on Bureau of Mines Approvals of Electrical Equipment. U.S. Bur. Mines—Information Circular, no. 6036, May 1927, 11 pp. Answers numerous questions asked as to how Bureau of Mines carries on its work of inspection, testing and approval of electrical equipment for permissible use, and what its recommendations are for promotion of safety in mines.

ELECTRICAL INSPECTION. One Hundred and One Questions on Electrical Inspection in and About Mines. U.S. Bur. Mines—Information Circular, no. 6037, May 1927, 7 pp. Indicates more important points that should be observed in making electrical inspection.

MOULDING METHODS

LOSSES, REDUCTION OF. The Reduction of Moulding Losses, R. A. Greene. Am. Foundrymen's Assn.—Advance Paper, no. 9, for mtg. June 6-10, 1927, 11 pp., 3 figs. Problem of what can be done to get closer union or co-operation between moulders, instructors, foremen, metallurgists engineers and other groups with main idea of producing quality castings with low loss.

MOULDS

THICKNESSING. Thicknessing Moulds to Produce Cylinder Castings, B. Shaw and J. Edgar. Foundry Trade Jl., vol. 35, no. 560, May 12, 1927, pp. 404-405, 7 figs. Principle of thicknessing in its application to moulds swept about a vertical spindle.

MORTARS

BRICK. Improved Brick Mortars, L. E. Weymouth. Am. Soc. Testing Matls.—Advance Paper, no. 58, for mtg. June 20-24, 1927, 18 pp., 4 figs. Results of series of tests on 60 different brick mortars ranging from very plastic to very lean mixes.

MOTOR TRUCK TRANSPORTATION

INTER-FACTORY. Inter-Factory Transport, W. F. Bradley. Motor Transport, vol. 44, no. 1157, May 16, 1927, pp. 573-576. How tractors and trailers and standardized container system are used for conveyance of parts and materials in and between Citroen factories in Paris.

MOTOR TRUCKS

ELECTRIC. Electric Motor Trucks (Les chariots de transport électriques), V. Neveux. Génie Civil, vol. 90, no. 9, Feb. 26, 1927, pp. 213-216, 9 figs. Describes different types of electric trucks, including those with stationary platform, lift trucks and tractor-trailer trucks.

N

NICKEL

MANUFACTURE. The Manufacture of Nickel by the Mond Nickel Company, Ltd. Chem. & Industry, vol. 46, no. 17, Apr. 29, 1927, pp. 386-391. Process used is comparatively simple in laboratory, but its amplification into economical works operation is matter of considerable difficulty.

NITRATES

MINING. Mining Nitrates with Electric Shovels. Min. Congress Jl., vol. 13, no. 5, May 1927, pp. 369-370, 1 fig. System of mining to be inaugurated by Anglo-Chilean Consolidated Nitrate Corp., which includes first attempt in history of nitrate production to use power shovels.

NON-FERROUS METALS

METALLURGY. Recent Progress in Non-Ferrous Metallurgy, W. H. Bassett. Min. & Met., vol. 8, no. 245, May 1927, pp. 214-218. Deoxidizing of copper; effect of impurities in copper; copper-rich brass; silicon for hardening; cupro-nickel; high-strength conductors.

NOZZLES

FLAT PLATE, REACTION OF. The Reaction of a Nozzle on a Flat Plate, C. Boehnlein. Mech. Eng., vol. 49, no. 6, June 1927, pp. 671-677, 11 figs. Static and dynamic reactions of jet; effect of position of plate on discharge of nozzle; distance plate must be from nozzle to give full discharge.

O

OPEN-HEARTH FURNACES

DEVELOPMENTS. Open-Hearth Furnace, Past and Present, C. S. Nugent. Blast Furnace & Steel Plant, vol. 15, no 5, May 1927, pp. 225-226. Practical furnace operator reviews development to present day; manner of constructing modern furnace; operating features.

OIL

PRODUCTION FROM COAL. The Production of Liquid Fuels from Coal, J G. King. Chem. & Industry, vol. 46, no. 20, 1927, pp. 181T-186T. Discusses low-temperature carbonization; hydrogenation; catalytic reduction of CO.

OIL ENGINES

Cost Prediction. Predicting Oil-Engine Costs, M. J. Reed. Power, vol. 65, no. 22, May 31, 1927, pp. 845-848, 5 figs. Use of charts enables prospective costs to be calculated; fuel costs and assumed overhead charges most important; influence of wages and repairs on total costs.

Oil Jets. Experiments on Oil Jets and Their Ignition, A. L. Bird. Instn. Mech. Engrs.—Proc., no. 5, 1926, pp. 955-986 and (discussion) 986-995, 18 figs. Author has constructed vessel in which most of experiment can be carried out and in which it is also possible to see what is going on during injection and subsequent combustion.

Oil Sprays. The Study of Oil Sprays for Fuel Injection Engines by Means of High-Speed Motion Pictures, E. G. Beardsley. Am. Soc. Mech. Engrs.—Advance Paper, for mtg. May 23-26, 1927, 16 pp., 11 figs. Apparatus for recording photographically start, growth and cut-off of oil sprays from injection valves has been developed at Laboratory of National Advisory Committee for Aeronautics at Langley Field, Va.

OIL SHALES

Carbonization. Low-Temperature Carbonization of Nevada Shales, D. Brownlie. Gas. Engr., vol. 43, no. 613, May 1927, pp. 112-113, 2 figs. Describes Catlin large-scale commercial experimental plant which has been in commercial operation for number of years.

OXY-ACETYLENE WELDING

Chemical Plants. Oxy-Acetylene Welding in Chemical Plant Construction, G. O. Carter and W. B. Miller. Indus. & Eng. Chem., vol. 19, no. 6, June 1927, pp. 695-697, 4 figs. Study of construction materials necessary; welding operation; advantages of welded joints.

Steam Pipe Lines. Gas Welding vs. Flange Joints for Steam Lines, G. O. Carter. Power, vol. 65, no. 22, May 31, 1927, pp. 823-824. Arguments for replacement of flange joints by welding; ability to stand thrust and pull of pipe bends; taking care of expansion and contraction; importance of procedure control; insulation problem; saving money on tunnel lines; demand for flangeless valves and fittings.

P

PAPER MILLS

Newsprint. Reducing Costs and Increasing Efficiency in the Newsprint Paper Industry, G. D. Bearce. Mfg. Industries, vol. 13, no. 6, June 1927, pp. 415-420, 7 figs. Review of development and improvement in machinery and equipment; technical process and operating control; factor in cost reduction; importance of operating records; steam plant improvements.

PLOW

Steam-Driven. Powerful Steam Cultivating Machinery for Italy. Engineer, vol. 143, no. 3724, May 27, 1927, pp. 581-582, 3 figs. Details of machinery on cable system, designed by J. Fowler & Co., Leeds, England.

POWER FACTOR

Improvement. Losses Produced by Low Power Factor and Their Remedy, G. G. Green. Nat. Engr., vol. 31, no. 6, June 1927, pp. 267-269, 3 figs. Advantages of improved power factor; use of synchronous condensers; capacitors.

POWER TRANSMISSION

Equipment. Transmission Parts—Oiling (Les organes de transmission—le graissage). Technique Moderne, vol. 19, no. 10, May 15, 1927, pp. 293-296, 10 figs. Deals with bearings, clutches and coupling shafts; tendency in France towards standardization of these transmission parts; circulating oiling system; elastic coupling; applications of ball and roller bearings; lubrication; purification of used oils; belts and chains.

PRESSURE VESSELS

Heads. The Design of Dished and Flanged Pressure-Vessel Heads, A. B. Kinzel. Mech. Eng., vol. 49, no. 6, June 1927, pp. 625-628 and (discussion) 636-644, 9 figs.

Heads. Strains in Dished Heads, E. Höhn. Mech. Eng., vol. 49, no. 6, June 1927, pp. 632-635, 9 figs. Through number of independent experiments best form for dished heads was determined from values of measured stress conditions on outside strain conditions on inside are calculated. Translated from V.D.I. Zeit., vol. 69, no. 6, Feb. 7, 1925, pp. 155-158.

PRESSWORK

Handling Sheet Steel. Vacuum System for Handling Sheet Steel in Press Work, P. J. Edmonds. Am. Mach., vol. 66, no. 23, June 9, 1927, pp. 984-985, 3 figs. Vacuum system in operation in metal-stamping department of Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., provides economical and effective means of handling sheet steel for blanking laminations for electrical apparatus.

PUMPING STATIONS

Chicago. A New 300-M.G.C. Pumping Station in Chicago. Water Wks., vol. 66, no. 6, June 1927, pp. 215-221, 10 figs. How William Hale Thompson pumping station was designed and is being built to serve industrial and residential section of 19 sq. mi. as part of modern development of city system.

Oil-Engine-Driven. Oil-Engine-Driven Pumping Plant at Epsom Waterworks. Engineer, vol. 143, no. 3724, May 27, 1927, pp. 569-572, 7 figs. Comprises 400-b.h.p., 4-cylinder Crossley-Premier oil engine which drives, by means of ropes, Worthington-Simpson 4-stage high-lift turbine pump geared to 2-stage vertical high-lift turbine pump.

PUMPS

Air-Lift. The Air-Lift Pump Made Simple, Wm. V. Fitzgerald. Power, vol. 65, no. 21, May 24, 1927, pp. 776-778, 3 figs. Some think of air lift in terms of difference in density of two columns of fluid, one being solid water and other mixture of water and air bubbles; others explain action as that of succession of water pistons separated by units of expanding air; writer believes second theory to be more accurate and develops it in way that is easily followed.

Ancient Types. The Romance of the Water Pump. Water Wks. Eng., vol. 80, no. 12, June 8, 1927, pp. 785-786 and 873, 9 figs. Ancient communities designed pumps to aid in irrigation work and to remove water from mines; stages in progress.

R

RADIOTELEGRAPHY

Short-Wave. High-Angle Radiation of Short Electric Waves, S. Uda. Inst. Radio Engrs.—Proc., vol. 15, no. 5, May 1927, pp. 377-385, 9 figs. Accounts of experimental work and test results on new wave projector devised by author, with special reference to high-angle radiation of short electric waves.

RAILWAY MOTOR CARS

Diesel-Engined. Diesel Cars Reduce Operating Costs on C.N.R. Ry. Age, vol. 82, no. 27, June 4, 1927, pp. 1739-1742, 3 figs. After year's service, road is building five additional units of modified design.

Gasoline. New Petrol-Driven Rail Motor Cars for Spain. Ry. Engr., vol. 48, no. 569, June 1927, pp. 234-236, 2 figs. Interesting features incorporated in design of 105-h.p. Simplex cars.

Steam-Propelled. New Steam-Propelled Rail Cars for the London & North Eastern Railway. Ry. Gaz., vol. 46, no. 19, May 13, 1927, pp. 624-626, 4 figs. Latest development of Sentinel-Cammell type.

RECTIFIERS

Mercury-Arc. Application of Mercury-Arc Power Rectifiers, C. A. Butcher. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 5, May 1927, pp. 446-450, 5 figs. Information on characteristics of rectifiers and comparisons with rotating converters as to operation, cost, floor space, weight, etc.

Modern Mercury-Arc Power Rectifiers, O. K. Marti. Eng. Jl., vol. 10, no. 5, May 1927, pp. 253-259 and (discussion)) 260-261, 14 figs. Their uses and application in converting alternating to direct current.

REFRACTORIES

Specifications. Report of Committee C-8 on Refractories. Am. Soc. Testing Matls.—Advance Paper, no. 48, for mtg. June 20-24, 24 pp. Proposed tentative specifications for clay firebrick for malleable furnaces with removable bungs and for annealing ovens and for stationary boiler service and marine-boiler service; proposed tentative definitions of terms relating to refractories.

REFRIGERATING MACHINES

CO_2 Compressors. Application of Direct-Connected Synchronous Motors to Carbon Dioxide Compressors, D. W. McLenegan. Power, vol. 65, no. 21, May 24, 1927, pp. 782-783, 2 figs. Abstract of paper read before Nat. Assn. of Practical Refrig. Engrs.

High-Speed Compressors. High-Speed Refrigerating Compressors, J. C. Goosman. Power Plant Eng., vol. 31, no. 11, June 1, 1927, pp. 641-642. Europe's slender resources compared to those of United States responsible for development of high-speed compressors.

RESERVOIRS

Covered. Building 6-M.G. Covered Reservoir at Madison, Wis., L. A. Smith. Eng. News-Rec., vol. 98, no. 21, May 26, 1927, pp. 852-855, 6 figs. Circular concrete reservoir with counterfort outer and partition walls; roof carried by walls and by columns; concrete placed by crawler crane and bucket.

ROAD MATERIALS

Specifications. Report of Committee D-4 on Road and Paving Materials. Am. Soc. Testing Matls.—Advance Paper, no. 61, for mtg. June 20-24, 1927, 8 pp. Proposed revision of existing standard specifications and method of test; proposed withdrawal of standard method of test.

ROADS, CONCRETE

Deterioration. Causes of Concrete Pavement Deterioration, J. S. Bixby. Eng. News-Rec., vol. 98, no. 20, May 19, 1927, pp. 810-811. Relation of structure, materials and foundations to concrete road behaviour determined by census of North Atlantic highways. Text is made up from extracts from long report made to Assn. of Highways Officials of North Atlantic States and full report will be published by N.Y. State Dept. of Pub. Wks.

Local Materials for. The Use of Local Materials for Concrete Construction, A. M. Jackson. Eng. Jl., vol. 10, no. 6, June 1927, pp. 309-311. Precautions taken in construction of roads in Brant County, including predetermination of strength of concrete.

ROLLING MILLS

Cold Strip Rolling. Cold-Rolled Strip Steel, T. Swinden and G. R. Bolsover. Iron & Coal Trades Rev., vol. 114, no. 2088, May 6, 1927, pp. 724-727, 18 figs. Effect of progressive cold-rolling on steels of different composition, and on steels of similar composition, but in different conditions as regards heat treatment prior to cold-rolling; effect of heat treatment on some of above steels after they had received varying amounts of cold rolling. Abstract of paper read before Iron & Steel Inst.

Rod Mills. Heavy Rod Milling Machine. Iron Age, vol. 119, no. 23, June 9, 1927, p. 1671, 1 fig. Features of improved 58-in. unit include independent cross-rail down-feed, brought out by Niles Tool Works Co.

Strip Mills. Roll Thin Strip Steel on 4-High Mill, F. B. Pletcher. Iron Trade Rev., vol. 80, no. 21, May 26, 1927, pp. 1329-1331, 3 figs. Second four-high strip mill, placed in operation in St. Louis district.

Wire-and-Rod. Sparrows Point Wire and Rod Mill, G. A. Richardson. Iron Age, vol. 119, no. 18, May 5, 1927, pp. 1291-1297, 5 figs. Methods and equipments employed at mill of Maryland plant of Bethlehem Steel Co.; straight line layout 1,525 ft. long provides continuous flow of materials; rod mill has 17 stands. See also description in Am. Metal Market, vol. 34, no. 118, June 1927, pp. 13 and 15-17, 8 figs.

ROLLS

Thermit Repair Welding. Repairing Mill Rolls with Thermit. Iron Trade Rev., vol. 80, no. 24, June 16, 1927, pp. 1536-1537, 3 figs. Easy method described for building up worn wabbler ends; how moulds are made and placed.

ROOFS

Materials. Report of Committee D-8 on Bituminous Waterproofing and Roofing Materials. Am. Soc. Testing Matls.—Advance Paper, no. 64, for mtg. June 20-24, 1927, 18 pp. Proposed withdrawal of existing tentative specifications and method of test; co-operative tests on analysis of roofing felt for fibre composition; asphalt for use in constructing built-up roofs; tentative method of testing bituminous materials for coarse particles by elutriation; analysis of roofing felt for fibre composition.

S

SAND MOULDING

Grading. A Tentative Standard Method for Grading Foundry Sands. West Machy. World, vol. 18, no. 5, May 1927, pp. 221-222. Fineness test; grain-fineness number; grian fineness classification; clay-content classification.

Routine Control. Routine Sand Control in the Pipe Foundry, M. Kuniansky. Am. Foundrymen's Assn.—Advance Paper, no. 7, for mtg. June 6-10, 1927, 6 pp.

Steel Castings. Characteristics of Some Steel Moulding and Core Sand Materials, E. R. Young. Am. Foundrymen's Assn.—Advance Paper, no. 18, for mtg. June 6-10, 1927, 12 pp. Survey of common materials, their behaviour described in shop terms.

SCREW THREADS

Pitch-Measuring Machine. Screw Thread Pitch-Measuring Machine. Machy. (N.Y.), vol. 33, no. 9, May 1927, pp. 710-711, 2 figs. Apparatus brought out by Société Genevoise d'Instruments de Physique, Geneva, Switzerland.

SEWER CONSTRUCTION

COMPRESSED-AIR APPLICATION. Compressed Air Permits Sewer Work Under Street. Water Wks., vol. 66, no. 6, June 1927, pp. 240-243, 8 figs. How Broadway sewer in Chicago is being laid by mining methods to avoid traffic tie-ups; heading in water-bearing saud and bench in clay easily driven and brick lining laid up by means of light air pressure.

SHEET METAL

ASSEMBLING. Thickness of Assembled Sheets, J. K. Olsen. Machy. (N.Y.), vol. 33, no. 10, June 1927, pp. 755-757, 2 figs. Variations in total thicknesses of number of assembled sheets and method of determining proper length of screws, rivets or bushings.

SMOKE

ABATEMENT. Discussion of Papers Presented at Session on Smoke Abatement. Mech. Eng., vol. 49, no. 6, June 1927, pp. 657-662. Discussion of paper by O. P. Hood, W. C. White and Osborn Monnett, two of which were published in mid-Nov. issue of Journal, and one by W. C. White in this issue.
The Law Relating to Smoke Abatement, J. L. Turner. Surveyor (Lond.), vol. 71, no. 1843, May 20, 1927, pp. 517-518. British statutory provisions.

BOILER. Boiler Smoke and Its Prevention, C. F. Wade. Power Engr., vol. 22, no. 255, June 1927, pp. 205-206. Human element; technical education; smoke abating apparatus; secondary air; additional combustion space.

PHYSIOLOGICAL EFFECT. What is Known About the Effect of Smoke on Health, W. C. White. Mech. Eng., vol. 49, no. 6, June 1927, pp. 655-656. Investigations on physiological effect of smoke; proposed plan for further investigation; physilogical effects of carbon particles in smoke; physiological effects of other dusts in smoke.

SPEED REDUCERS

CALDWELL. Caldwell Speed Reducers. Am. Mach., vol. 66, no. 23, June 9, 1927, pp. 995-996, 1 fig. Designed particularly for conveyor and elevator service, but is also applicable to other kinds of machines.

MOTOR DRIVE. Motor Drives Through Worm Speed Reducers, Chains and Variable-Speed Transmissions, G. Fox. Indus. Engr., vol. 85, no. 5, May 1927, pp. 209-215, 9 figs. Considerations involved in connecting motor to its load through worm-gear reduction units, variable- or adjustable-speed transformers and chain drives.

SPRINGS

DESIGN. The Design of Small Springs, J. S. Barker. Am. Mach., vol. 66, no. 24, June 16, 1927, pp. 1018-1019. Presents table giving values of load divided by deflection per coil for various sizes of wire and coils.

HAIRSPRINGS FOR INSTRUMENTS. The Manufacture and Properties of Hairsprings, H. Moore and S. Beckinsale. Inst. of Metals—Advance Paper, no. 424, for mtg. Mar. 9-10, 1927, 9 pp.; also abstract in Engineering, vol. 123, no. 3195, Apr. 8, 1927, pp. 439-440. Investigation at Research Department, Woolwich, into manufacture and properties of several types of hairsprings for instruments.

HEAT TREATMENT. The C.N.R. Installs Spring Treating Plant. Ry. Mech. Engr., vol. 101, no. 6, June 1927, pp. 341-344, 6 figs. Electric furnace and salt bath for heating and drawing, at Stratford, Ont., shops, are pyrometer controlled.

TESTING. Device for Testing Compression and Elongation of Springs. Iron Age, vol. 119, no. 23, June 9, 1927, pp. 1671-1672. Spring-testing machine, known as Elasticometer, placed on market by Coats Machine Tool Co., New York.; device is essentially a precision beam balance with ratio of 10 to 1.

STACKS

HEIGHT. Effect of Height of Stack on Furnace Operation, W. H. Mawhinney. Fuels & Furnaces, vol. 5, no. 5, May 1927, pp. 579-581, 3 figs. As height of stack is increased, furnace pressure varies rapidly with variations in fuel consumption and changes in furnace pressure are much greater.

STANDARDIZATION

AGENCIES. Action Urged on Standardization, L. W. W. Morrow. Elec. World, vol. 89, no. 21, May 21, 1927, pp. 1057-1060. Agencies engaged in standards work; controversial situations indicated; need of national perspective and development of centralized authority.

INDUSTRIAL EFFECTS. Standardization and Its Effect on Industry, G. K. Burgess. Am. Mach., vol. 66, no. 20, May 19, 1927, pp. 808-809. Review of developments.

LIMITS OF. The Sane Limits of Industrial Standardization, N. F. Harriman. Indus. Mgmt. (N.Y.), vol. 73, no. 6, June 1927, pp. 363-365.

STEAM

HIGH-PRESSURE. The Economic Value of Increased Steam Pressure, H. L. Guy. Instn. Mech. Engrs.—Proc., no. 1, 1927, pp. 99-128 and (discussion) 129-213, 34 figs. Considers gains to be expected from adoption of increased pressures in simple condensing turbine installation; state of knowledge of properties of steam; effect of regenerative feed heating and resuperheating; increase in capital cost per kw. with increasing initial pressure at turbine stop valve.
Results Obtained with High-Pressure Steam at Langerbrugge Power Station. Engineer, vol. 143, no. 3723, May 20, 1927, p. 550. Steam temperature employed, 840 deg. Fahr., is higher than that of any other station in world and boiler pressure is 800 lb. per sq. in.; results of tests and operating results.

RANKINE CYCLE. Chart for Estimating the Efficiency of the Rankine Cycle. Engineering, vol. 123, no. 3202, May 17, 1927, p. 650, 1 fig. Main curves give theoretical thermal efficiency using saturated steam at pressures stated, and expanding it down to any vaccum between 27 and 29.1 in.

STEAM ENGINES

GOVERNING BY DOUBLE ECCENTRIC. Why Is a Double Eccentric Used? Power, vol. 65, no. 21, May 24, 1927, pp. 784-785, 7 figs. Principal limitation of simple D-slide valve is eliminated by double eccentric gear, and efficient means of governing is provided.

STEAM POWER PLANTS

CHARACTERISTICS. Some Characteristics of Modern Steam Plants, F. J. Garland. Eng. & Boiler House Rev., vol. 40, no. 11, May 1927, pp. 570-576, 2 figs. Layout of plant; auxiliaries; types of boilers.

DESIGN. Considerations Influencing the Design of Steam Generating Plants, W. H. Reynolds. Instn. Mech. Engrs.—Proc., no. 5, 1926, pp. 943-953, 5 figs. Deals with size of boiler; steam pressure, temperature and reheating; furnace design.
Recent Developments in Power Plant Design and Their Effect on the Economy of Generation, T. Roles. Engineering, vol. 123, no. 3203, June 3, 1927, p. 668. Review of developments in America and Europe. Abstract of paper read before Incorporated Municipal Electrical Assn.

HIGH-PRESSURE. Economic Value of Increased Steam Pressure, H. L. Guy. Elec. Rev., vol. 100, no. 2579 and 2580, Apr. 29 and May 6, 1927, pp. 697-699 and 738-741, 14 figs. Results of investigations on effects of steam-pressure increase on operation and plant efficiencies and costs, with considerations on selection of particular pressures. Abstract of paper read before North-Western Branch of Inst. of Mech. Engrs.
The Use and Economy of High-Pressure Steam Plants, A. L. Mellanby and W. Kerr. Instn. Mech. Engrs.—Proc., no. 1, 1927, pp. 53-98 and (discussion) 129-213, 16 figs. Field for high-pressure plants; main influences of high steam conditions; steam cycle and its probable limits; progress towards limits.

LIFTING HEAVY EQUIPMENT. Lifting Heavy Power Plant Equipment, N. L. Rea. Power, vol. 65, no. 24, June 14, 1927, pp. 994-996, 8 figs. Attention is called to number of methods that have been used to lift heavy pieces of power plant equipment that have proved satisfactory as to safety and building cost.

STEAM TRAPS

TYPES AND CHARACTERISTICS. Steam Traps, J. O. Frazier. S. Power Jl., vol. 45, no. 6, June 1927, pp. 53-58, 4 figs. Their general types and characteristics; their practical installation and operation, with particular reference to direct-return traps.

STEAM TURBINES

BUCKET WHEELS. The Application of Magnetics to the Inspection of Steam Turbine Bucket Wheels, J. A. Capp. Am. Soc. Testing Matls.—Advance Paper, no. 40, for mtg. June 20-24, 13 pp., 9 figs.

ELBOW DESIGN. New Data for the Design of Elbows in Duct Systems, L. Wirt. Gen. Elec. Rev., vol. 30, no. 6, June 1927, pp. 286-296, 19 figs. Data on losses in variety of elbows determined in new, and, it is believed, more accurate way in Turbine Research Laboratory of General Electric Co.; it describes and evaluates large effect of aspect ratio on loss in elbows and describes how to design blade turns that reduce loss in bad elbows from 150 to 22 per cent of energy in velocity head.

MIXED-PRESSURE. Mixed-Pressure Turbines for Colliery Use, C. H. Naylor. Iron & Coal Trades Rev., vol. 114, no. 3087, Apr. 29, 1927, pp. 682-683. Choice between high-pressure turbo and mixed-pressure turbo-alternator drives; mixed-pressure turbine is so designed that it will utilize all low-pressure steam available before it makes call upon high-pressure steam; steam accumulators; comparisons of costs per year.

SUPER-SATURATED EXPANSIONS. Super-Saturated Expansions. Engineering, vol. 123, no. 3199, May 6, 1927, pp. 535-537, 1 fig. If assumption is made that steam behaves in same way when it passes through turbine as it would in cylinder of reciprocating engine, it can be shown that hypothesis as to respective temperatures of vapour and condensate leads to results which are in good quantitative agreement with those observed in actual practice; in super-saturated expansions steam temperature follows Wilson line and condensate temperature saturation line.

STEEL

HARDENING POINT. Use of Pyrometer to Determine Hardening Point of Steel, A. F. Hanley. Am. Mach., vol. 66, no. 23, June 9, 1927, pp. 986-987, 1 fig. Method which may be employed to determine desired critical hardening temperature.

HEAT-RESISTING. Heat-Resisting Steels, W. H. Hatfield. Iron & Steel Inst.—Advance Paper, no. 9, for mtg. May 1927, 26 pp., 1 fig. Account of investigations carried out in Brown-Firth Research Laboratories.

PICKLING. Some Notes on the Pickling of Steel, W. H. Ibbotson. Indus. Chemist, vol. 3, no. 27, Apr. 1927, p. 147-148. Pickling by sulphuric acid; process using hydrochloric acid; review of salient points.

SOLDER PENETRATION. The Penetration of Mild Steel by Brazing Solder and Other Metals, R. Genders. Inst. of Metals—Advance Paper, no. 430, for mtg. Mar. 9-10, 1927, 7 pp., 8 figs. Cracking of mild steel under slight stress when heated and wetted with brazing solder is due to rapid intercrystalline penetration of steel by brass; copper behaves similarly to brass, but zinc, tin and lead-tin solder have no perceptible action; behaviour of mild steel in comparison with that of other metals when stressed and exposed to corrosive media.

STEEL MANUFACTURE

DUPLEX PROCESS. The Manufacture of Steel in India by the Duplex Process, B. Yancke. Iron & Steel Inst.—Advance Paper, no. 16, for mtg. May 1927, 29 pp. Duplex process is combination of Bessemer and open-hearth methods of steel manufacture, and consists of desiliconizing and partly or almost completely decarburizing molten pig iron from blast furnace in acid-lined Bessemer converter, and subsequently dephosphorizing metal in basic open-hearth furnace; this process is practised successfully in India by Tata Iron and Steel Co. under difficult climatic conditions with more than 99 per cent of native labour at their works at Jamshedpur. See also Abstract in Iron & Coal Trades Rev., vol. 114, no. 2088, May 6, 1927, pp. 727-732.

RESEARCH. Fundamental Research in Steel Manufacture, C. H. Herty, Jr. Am. Soc. Steel Treat.—Trans., vol. 11, no. 6, June 1927, pp. 899-911 and (discussion) 911-914 and 1015. Classifies problems encountered in making of steel and points out that field for fundamental research in its manufacture is astounding in its magnitude and intricacies; consideration of fundamental research which deals primarily with slag-metal reactions, giving particular attention to formation and elimination of non-metallic inclusions formed from manganese, silicon aluminum.

STEEL WORKS

ELECTRIFICATION. Colorado Steel Mill Electrification. Iron Age, vol. 119, no. 17, Apr. 28, 1927, pp. 1205-1208, 3 figs. New power plant, motor drives, powdered-fuel plant and electrical cleaning of blast-furnace gas.

WASTE-HEAT UTILIZATION. Waste-Heat Utilization at an Iron and Steel Works. Power Eng., vol. 22, no. 255, June 1927, pp. 208-219 and 227, 22 figs. Describes generating plant and interesting applications of power at iron and steel works of Consett Iron Co., Ltd., Durham.

STRESSES

FILLETS UNDER LOADING. Stresses in Fillets Under Transverse, Tension or Compression Loadings and Under Torsion Loading, E. F. Garner. Sibley Jl. of Eng., vol. 41, no. 5, May 1927, pp. 150-151 and 166 and 168, 4 figs.

SUBSTATIONS

AUTOMATIC. Sound-Proof Automatic Substations, R. L. Hall. Elec. Jl., vol. 24, no. 6, June 1927, pp. 273-276, 5 figs. Two substations installed in Vancouver by British Columbia Electric Railway, Ltd.

SUPERHEATED STEAM

SHIPS. Superheat Improves Operation, F. Page. Mar. Rev., vol. 57, no. 6, June 1927, pp. 13-15, 3 figs. Compares performance of S.S. West Haven with and without superheat; better economy due to superheat saves $7,600 a year.

STOKERS

UNDERFEED. Underfeed Stokers Show Steady Improvement, J. G. Worker. Power Plant Eng., vol. 31, no. 11, June 1, 1927, pp. 615-617. Multiple-retort underfeed stoker successfully adapted to coal from all fields and for use with water walls and preheated air.

T

TANKS

Elliptical Stresses in. Stresses Occurring in the Walls of an Elliptical Tank Subjected to Low Internal Pressures, W. M. Frame. Mech. Eng., vol. 49, no. 6, June 1927, pp. 619-624, 12 figs. Describes test made on elliptical tank, and presents analysis based on experimental data, from which stresses set up in walls may be calculated.

TANTALUM

Properties. Tantalum—A Rival for Platinum. Eng. & Min. Jl., vol. 123. no. 22, May 28, 1927, p. 888. Working properties of tantalum are such that it can be worked cold, drawn, hammered, machined, polished, hardened, rolled and punched; pure metal is rather easily worked; it is highly resistant to chemical corrosion.

TELEPHONY

Distortionless Transmission. A Note on Distortionless Telephonic and Telegraphic Transmission, A. C. Barltett. Lond., Edinburgh and Dublin Philosophical Mag. & Jl. of Science, vol. 3, no. 17, Apr. 1927, pp. 959-963, 4 figs. It is of interest to know if in any case there exists network that, when associated with uniform line, gives an exact solution of problem of rendereding line distortionless; shows such network can be devised, though it requires double infinity of simple impedance elements and considerably increases attenuation.

THERMOMETERS

Specifications. Report of Committee D-15 on Thermometers. Am. Soc. Testing Matls.—Advance Paper, no. 68, for mtg. June 20-24, 2 pp.

TIME STUDY

Morale as Factor. Morale as a Factor in Time-Study Technique, M. L. Cooke. Mech. Eng., vol. 49, no. 6, June 1927, pp. 595-599, 2 figs. As illustrated by recent investigation of production standards used in garment industry in Cleveland, Ohio.

Observer's Analysis. Analyzing the Production Operation. E. F. Brown. Am. Mach., vol. 66, no. 24, June 16, 1927, pp. 999-1000. Attempts to show how efficient time-study man analyzes all phases of operation, as well as studies the worker.

TRACTORS

Lug Studies. Tractor Lug Studies on Sandy Soil, J. W. Randolph. Agric. Eng., vol. 8, no. 4, Apr. 1927, pp. 71-75, 5 figs. Field studies on sandy soil at Alabama Agricultural Experiment Station; factors affecting traction of wheel tractors. See reference to first article in Eng. Index 1926, p. 761.

TUNNELS

Ventilation. Studies and Methods Adopted for Ventilating the Holland Vehicular Tunnels. Eng. News-Rec., vol. 98, no. 23, June 9, 1927, pp. 934-939, 10 figs. Lack of information on amount of vitiation of air in tunnels leads to extensive studies of motor exhaust gas and effect on human beings; fan system insures adequate air supply.

TURBO-ALTERNATORS

Parsons. 20,000 K.W. Parsons Turbo-Alternator at Rotterdam. Engineer, vol. 143, nos. 3722 and 3723, May 13 and May 20, 1927, pp. 512-513 and 540-541, 12 figs. partly on supp. plate. Turbine is pure reaction machine consisting of two cylinders arranged in tandem directly coupled to alternator and to exciter; speed of set is 3,000 r.p.m. and most economical load is 16,000; complete turbine consists of 34 rows of moving blades in series; alternator is totally enclosed turbo type designed for continuous output of 20,000 at 5,500 volts with 80 per cent power factor.

TURBO-GENERATORS

100,000-Kw. Another "Largest" Turbine. Power, vol. 65, no. 22, May 31, 1927, pp. 832-833, 2 figs. Commonwealth Edison Co., of Chicago, Ill., placed with South Philadelphia works of Westinghouse Elec. & Mfg. Co., order for 100,000-kw. steam turbine-generator unit and necessary condensing equipment.

V

VOLTAGE REGULATION

66,000-Volt System. Voltage Regulation on the N.E. Coast 60,000-Volt System. Elec. Times, vol. 71, no. 1855, May 12, 1927, pp. 651-652, 4 figs. Voltage-regulating equipment which is in service at two of main power stations on North-East Coast system.

W

WAGES

Relation to Costs. High Wages and Prosperity, H. H. Williams. Indus. Mgmt. (N.Y.), vol. 73, no. 6, June 1927, pp. 325-327. Discusses transparent delusion that high wages mean higher costs; revelation of facts; high wages force adoption of machinery, with resultant lower costs.

WATER FILTRATION

Experimental Plant. Working in Laboratory and Experimental Plant to Solve Filtration Problems. Water Wks., vol. 66, no. 6, June 1927, pp. 225-227, 5 figs. Chicago is building experimental plant large enough for actual plant for average city in order to solve problems encountered in filtering its water supply before committing itself on design of actual plants.

Mechanical. Interesting Features of Mechanical Filtration, Z. Rudolf. Water & Water Eng., vol. 24, no. 341, May 20, 1927, pp. 187-190. Studies of flow of water in filter wash water trough; hydraulic and operative features of mechanical filtration.

WATER MAINS

Corrosion. Corrosion in a Water Supply System and Methods of Protection, E. B. Stewart. Am. Water Wks. Assn., vol. 17, no. 5, May 1927, pp. 557-568. Theory of corrosion; soil corrosion and preventive measures; electrolysis; remedial measures applicable to structures; co-operative treatment of electrolysis problem.

WATER TREATMENT

Chlorination. Phenol Tastes in Chlorinated Water, L. C. Osborn. Am. Water Wks. Assn.—Jl., vol. 17, no. 5, May 1927, pp. 586-590. No preventive has been discovered as far as application of chlorine is concerned; present policy is to use as small amount as possible consistent with safe results; attempt was made to maintain about 0.1 part per million residual chlorine; author's conclusions.

Plants. New 12-M.G.D. Water Purification Plant for Oakland. Eng. News-Rec., vol. 98, no. 21, May 26, 1927, pp. 857-860, 5 figs. Aerator, mechanical alum mixer, joint coagulating and settling basin, single filter-operating stand and wash-water reclaimer.

Waste Water. Industrial Waste Waters and Their Treatment (Les eaux résiduaires industrielles et leur traitement), E. Rolants. Technique Moderne, vol. 19, no. 8, Apr. 15, 1927, pp. 237-246, 5 figs. Describes modern purification methods and their application to waste waters from sugar factory, etc.

WATER WORKS

Standardization. Report of Standardization Council. Am. Water Wks. Assn.—Jl., vol. 17, no. 5, May 1927, pp. 595-601. Committee on standpipes and water towers; steel pipe committee; standard methods of water analysis; boiler feedwater studies.

WELDING

Cast Aluminum. Welding Cast Aluminum. Mech. World, vol. 81, no. 2107, May 20, 1927, pp. 357-358. Describes operations and makes recommendations for welding.

Research. Developments and Research in Welding, D. H. Deyoe. Am. Welding Soc.—Jl., vol. 6, no. 4, Apr. 1927, pp. 48-58, 12 figs.

Welding Research Activities of the Newport News Shipbuilding & Dry Dock Company During 1926, J. W. Owens. Am. Welding Soc.—Jl., vol. 6, no. 4, Apr. 1927, pp. 59-73, 9 figs. Deals with research in resistance, gas, metallic-arc and thermit welding; corrosion tests.

Structural Steel. Application of Welding to a Steel Structure, J. H. Edwards. Am. Iron & Steel Inst.—Advance Paper, for mtg. May 20, 1927, 37 pp., 22 figs. Deals with electric resistance method; and fusion welding, either gas or electric.

Thermit. Research Activities of the Metal and Thermit Corp., J. H. Deppeler. Am. Welding Soc.—Jl., vol. 6, no. 4, Apr. 1927, pp. 43-46. Research activities of this corporation are carried on at its Jersey City plant; work includes welding research which has to do with development of iron thermits that will produce steel of proper physical characteristics.

Thermit Welding Practice Improved. Welding Engr., vol. 12, no. 5, May 1927, pp. 32-33, 3 figs. New methods of design and procedure reduce amount of materials used and improve quality of weld.

WELDS

Fatigue of. Fatigue of Welds, R. R. Moore. Am. Welding Soc.—Jl., vol. 6, no. 4, Apr. 1927, pp. 11-32, 21 figs. Results of tests relating to welding metal thicknesses not greater than 3/16 in. and usually not over 1/16 in., such as in case of steel-tube fuselage with welded joints; results are given for gas and arc welds and for atomic-hydrogen process; cast-steel tests; although tensile efficiency was better than 75 per cent, fatigue strength was as low as 13 and never higher than 35 per cent of tensile strength of weld; poor fusion has drastic effect upon resistance of weld to repeated stresses.

WIRE

Forming. Wire Forming Applied to Ring Manufacture, F. Server. Wire, vol. 2, no. 5, May 1927, pp. 158-160, 6 figs. Shows number of dies and have been used successfully for cutting off, bending and forming wire into rings.

WIRE DRAWING

Steel. The Drawing of Steel Wire and Its Relation to Qualities of Steel, E. A. Atkins. Iron & Coal Trades Rev., vol. 114, no. 2088, May 6, 1927, pp. 732-739, 5 figs. See also Engineering, vol. 123, no. 3200, May 13, 1927, pp. 591-594. Paper read before Iron & Steel Inst.

WIRE ROPE

Properties. Some Investigations on the Properties of Rope Wire, A. T. Adam. Wire, vol. 2, no. 5, May 1927, pp. 151-153, 4 figs. Notes on overdrawing, fatigue limit, internal stress and heating; reverse bend tests on wire patented in various sizes and drawn to 0.071 in. diameter.

WOOD PRESERVATION

Poles. Preservation of Wood Transmission Line Poles. Contract Rec., vol. 41, no. 20, May 18, 1927, pp. 484-485, 3 figs. Cause of decay; simple method practised by Toronto hydro preserves butts almost indefinitely.

WOOD-WORKING MACHINERY

Planing and Thicknessing. Panel Planing and Thicknessing Machine. Engineering, vol. 123, no. 3199, May 6, 1927, pp. 547-548, 1 fig. Made by Messrs. A. Ransome and Co.; it has single cutter block which operates on top of timber, this being fed in by four power-driven feed rollers along rising and falling table.

Z

ZINC METALLURGY

Recovery from Complex Ores. The Development of Zinc Recovery from Complex Ores, J. A. B. Forster. Chem. Eng. & Min. Rev., vol. 19, no. 223, Apr. 5, 1927, pp. 241-245. Early methods of concentration; improvements in concentration processes; treatment of zinc concentrates.

Engineering Index

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A

ABRASIVES

DUST HAZARD. Discuss Abrasive Dust Hazard, W. I. Clark and E. B. Simons. Abrasive Industry, vol. 8, no. 7, July 1927, pp. 230-232. On basis of 14 years' observation and of data presented, following conclusions seem to be justified: in factories which provide proper methods of dust removal, continuous inhalation of artificial abrasive dust, extending over many years, does not produce symptoms or present X-ray findings of pneumonokoniosis; workers who habitually use grinding wheels will run but slight risk of developing pneumonokoniosis if they use artificial abrasive rather than sandstone wheels for all grinding operations, and if machines upon which artificial abrasive wheels are mounted are properly hooded and excessive dust removed by suction fans. Reprinted from Jl. of Indus. Hygiene.

AERONAUTICS

EUROPEAN COMMERCIAL. Developments in European Commercial Aeronautics, B. V. York. Commerce Reports, no. 25, June 20, 1927, pp. 699-700. Greater cooperation, improved safety devices and extended facilities mark latest developments in European Air Services.

AIR CONDITIONING

AUDITORIUMS. The Cooling and Ventilation of the Minneapolis Auditorium, S. C. Bloom. Heat. & Vent. Mag., vol. 24, nos. 5 and 6, May and June 1927, pp. 53-58 and 58-60 and 62, 4 figs. Details of installation requiring 413,000 cu. ft. of air per minute, cooled by 3,000,000 gal. of well water per day. Abstract of paper presented before Chicago Section of Am. Soc. Refrig. Engrs.

HUMIDIFYING. Humidification and Its Cost, H. L. Alt. Heat. & Vent. Mag., vol. 24, no. 6, June 1927, pp. 75-77, 2 figs. Comparison of saving and expenditure of heat by increasing moisture content in air.

AIR COMPRESSORS

PORTABLE. A New Portable Air Compressor. Engineer, vol. 144, no. 3729, July 1, 1927, p. 18, 2 figs. Plant comprises four-cylinder compressor and is fitted with typhoon type gearing; made by Broom and Wade.

AIRCRAFT

INDUSTRY. Aircraft Resources, J. P. Van Zandt. West. Soc. Engrs.—Jl., vol. 32, no. 5, June 1927, pp. 164-169. Gives position of manufacturers of aircraft and reviews phases of air transport as it exists to-day; operators and manufacturers seem confident of their ability to handle any traffic that may be offered for transport by air and await growth of this business; greatest need is for adequate landing fields.

AIRPLANE ENGINES

DYNAMICAL FORCES. Dynamical Forces in Aircraft Engines, J. Morris. Roy. Aeronautical Soc.—Jl., vol. 31, no 198, June 1927, pp. 577-585, 8 figs. Observations on Major Carter's paper; includes reply to Captain Morris' observations.

WRIGHT WHIRLWIND. Lindbergh's Wright Whirlwind a Result of Seven Years' Development. Aviation, vol. 22, no. 25, June 20, 1927, pp. 1358-1359 and 1396, 2 figs. Work began on Feb. 28, 1920, and since that time 7 years' successive models of air-cooled radial engines have been produced.

The Wright Whirlwind Engine, F. C. Duston. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 805-810, 19 figs. Engine that made Lindbergh's, Chamberlin's and Byrd's record-making flights possible; constructional features and machining operations.

AIRPLANES

AUTOGYRO. The Theory of the Autogyro, H. Glauert. Roy. Aeronautical Soc.—Jl., vol. 31, no. 198, June 1927, pp. 483-498 and (discussion) 498-508, 6 figs. Deals with physical basis on which analysis rests and explains, as far as possible, any analytical results in terms of physical facts which they represent; conclusions which can be drawn from theory; discusses various aspects of problem; behaviour of freely rotating windmill regarded as lifting surface.

DESIGN. Apparent Present Tendencies in Airplane Design, V. E. Clark. Mech. Eng., vol. 49, no. 7, July 1927, pp. 727-730, 6 figs. Review of recent developments and practice in various countries, pointing out successful results obtained with designs of widely different types.

STREAMLINE CURVATURE. Effect of Streamline Curvature on Lift on Biplanes, L. Prandtl. Nat. Advisory Committee for Aeronautics—Tech. Memorandum, no. 416, June 1927, 11 pp., 2 figs. Problem is divided into two parts: (1) to determine lift of wing which is situated in curvilinear flow; and (2) to calculate curvature which one wing of biplane produces in vicinity of other; combination of these two relations leads to desired result.

AIRSHIPS

STATUS OF. Reflections on the Airship Situation, C. E. Rosendahl. U.S. Nav. Inst.—Proc., vol. 53, no. 7, July 1927, pp. 745-758. Discussion of merits of airship project; points out salient factors in history of airships that have escaped public attention largely because this information has not been available as freely as have other features; endeavours to show that airships have been restricted by certain features yet undeveloped, some more or less logically so, that have made full and fair demonstration of airship capabilities generally impracticable.

ALLOYS, IRON

BRINELL BALLS FOR. Iron-Carbon-Vanadium Alloy for Brinell Balls, G. W. Quick and L. Jordan. Am. Soc. Steel Treating—Trans., vol. 12, no. 1, July 1927, pp. 3-24 and (discussion) 24-26 and 50, 5 figs. Special alloy of about 2.9 per cent and 13 per cent vanadium has been experimentally used for Brinell balls in testing of steels of such hardnesses as cause ordinary Brinell balls to deform both elastically and plastically; these special balls, heat-treated, work-hardened and tested against steels of approximately 700 Brinell, flattened about one-half as much as Hultgren balls and one-fifth as much as ordinary Brinell balls; opinion that hardness obtainable in plain carbon steel by combined heat treatment and cold work is maximum hardness to be secured by such treatment, irrespective of composition of steel, is shown to be untrue; difference in flattening between iron-carbon-vanadium and Hultgren balls does not, however, appreciably effect hardness number of steels up to 700 Brinell.

ALUMINUM BRONZE

PROPERTIES. Aluminum Bronze, J. Strauss. Am. Soc. Steel Treating—Trans., vol. 12, no. 1, July 1927, pp. 68-105, 17 figs. Review of constitution, mechanical properties and resistance to corrosion of these aluminum-copper alloys with and without addition of other elements; survey of portion of non-ferrous field in which mechanical properties, heat-treatment practice and other features are closely allied to those of some ferrous products.

AMMONIA COMPRESSORS

CLEARANCE POCKETS. Why Clearance Pockets in Ammonia Compressors? G. Grow. Power, vol. 66, no. 2, July 12, 1927, pp. 58-59, 4 figs. Influence of clearance on compressor output; why variable clearance is needed on constant-speed machines; how increasing clearance affects mean effective pressure.

ASPHALT

FILLER-GRADE. Low-Temperature Ductility of Filler-Grade Asphalts, W. F. Smith. Am. Soc. Testing Matls.—Advance Paper, for mtg. June 20-24, 1927, 7 pp. Samples of filler-grade asphalts meeting requirements of A.S.T.M. tentative specifications for asphalt filler for brick pavements were found to be brittle at low temperatures; investigation disclosed records of partially blown asphalts being appreciably ductile at 0 deg. cent., whereas straight-run materials of similar consistency rarely were; analyses of 58 samples of filler-grade and paving cement asphalts are reported; substitution of ductility requirement at 0 deg. for present ductility requirement at 25 deg. cent. and for penetration at 0 deg. is recommended.

PAVING MIXTURES. The Recovery and Examination of the Asphalt in Asphaltic Paving Mixtures, J. H. Bateman and C. Delp. Am. Soc. Testing Matls.—Advance Paper, no. 75, for mtg. June 20-24, 1927, 6 pp. Method for extracting and recovering asphalt in asphaltic paving mixtures by which physical characteristics of asphalt are not materially changed; method makes use of common processes of extraction of asphalt, but introduces modification of usual procedure for distilling off solvent in recovery of asphalt; by use of partial vacuum, distillation may be carried out without materially affecting physical characteristics of asphalt in condition in which it is present in paving mixture; studies have shown that process of mixing asphalt with mineral aggregates causes oxidation of asphalt.

AUTOMOBILE ENGINES

AIR CLEANERS. Efficiency Test for Radiator Fan-Type Air-Cleaners, A. H. Hoffman. Soc. Automotive Engrs.—Jl., vol. 21, no. 1, July 1927, pp. 82-86, 6 figs. Since air cleaners of radiator fan type cannot be tested satisfactorily by older method, in which known weight of dust is fed directly into air stream entering air cleaner, special method was found necessary in which air cleaner under test is mounted in its normal position behind radiator fan that is located inside of elliptical wind tunnel within which fan circulates air.

IMPROVEMENT OF. Methods of Improving the Efficiencies and Powers of Motor Car Engines, G. L. DeLaplante. Univ. of Toronto Eng. Soc.—Trans., Apr. 1927, pp. 49-63, 9 figs. If design followed principles outlined by author, engine would resemble present racing-car engine, much more than present automobile engine; it would be small, compact, powerful, flexible, highly efficient and would probably use single sleeve-valve construction to ensure desired quietness; outstanding features would be supercharger, high speed and steam cooling.

AUTOMOBILE INDUSTRY

PRODUCTION STATISTICS. Extent of World Modernization on January 1, 1927, I. H. Taylor. Commerce Reports, no. 26, June 26, 1927, pp. 799-802. New census shows 27,650,267 automobiles in world use.

AUTOMOBILES

Brakes. Automobile Brakes (L'établissement des organes d'un frein, en particulier d'un frein d'automobile). Pratique des Industries Mécaniques, vol. 10, no. 3, June 1927, pp. 107-115, 23 figs. Study of diverse principles for brakes, especially brakes with interior jaws, mainly used in construction of automobiles.

The Torque-Equalized Brake, G. L. Smith. Soc. Automotive Engrs.—Jl., vol. 20, no. 6, June 1927, pp. 754-760, 8 figs. Means of accomplishing torque equalization and results of tests of torque-equalizing mechanisms of various designs, together with accompanying charts.

Springs. Notes on Valve-Spring Surge, W. T. Donkin and H. H. Clark. Soc. Automotive Engrs.—Jl., vol. 20, no. 6, June 1927, pp. 722-726, 1 fig.

Torque Amplifier for Steering. New Device Uses Engine Power to Reduce Steering Effort. Automotive Industries, vol. 56, no. 23, June 11, 1927, pp. 896-897, 3 figs. Torque amplifier developed by Bethlehem Steel Co. consists of two small drums driven in opposite directions at slow speed by universal-jointed shaft.

Transmissions. An Internal-Geared Four-Speed Transmission, S. O. White. Soc. Automotive Engrs.—Jl., vol. 20, no. 6, June 1927, pp. 761-765, 5 figs.

AUTOMOTIVE FUELS

Anti-Knock Compounds. The Effect of Metallic Vapours on the Ignition of Substances, A. Egerton and S. F. Gates. Instn. Petroleum Technologists—Jl., vol. 13, no. 61, Apr. 1927, pp. 244-255, 1 fig.

Note on the Effect of Certain Organic Compounds on the Igniting and "Knocking" Characteristics of Petrol, A. Egerton and S. F. Gates. Instn. Petroleum Technologists—Jl., vol. 13, no. 61, Apr. 1927, pp. 275-280.

The Significance of Igniting Temperatures, A. Egerton and S. F. Gates. Instn. Petroleum Technologists—Jl., vol. 13, no. 61, Apr. 1927, pp. 256-272, 1 fig. Experiments made on conditions affecting igniting temperatures; discusses significance of such temperatures.

Theories of Anti-Knock Action, A. Egerton and S. F. Gates. Instn. Petroleum Technologists—Jl., vol. 13, no. 61, Apr. 1927, pp. 281-299. Develops theory on combustion through autooxidation and of anti-knock action; summary of main facts regarding anti-knocks.

Future Supplies. Fuel for Internal Combustion Engines, F. L. Nathan. Chem. & Industry, vol. 46, no. 24, June 17, 1927, pp. 211T-220T. Conclusions as regards future supplies of fuels for internal-combustion engines.

Motor Fuels: Present and Future, J. Boot. Oil Eng. & Technology, vol. 8, no. 4, Apr. 1927, pp. 135-136. Summary of possible developments of supplies of fuels as alternatives to petroleum.

Starting Ability. Lean Explosive-Limits for Cracked and Straight-Run Gasoline and Other Motor Fuels, D. C. Ritchie. Soc. Automotive Engrs.—Jl., vol. 21, no. 1, July 1927, pp. 15-18, 6 figs. Method of determining limiting explosive mixtures of air and fuel vapour has been developed and applied to numerous motor fuels; data obtained indicate that lean explosive limit of 25 air-fuel ratio applies to quiescent mixtures of air and vapours of such fuels when ignited at centre of closed bomb of sufficient capacity; this value was found to apply equally well to cracked and straight-run gasoline.

AVIATION

Aerodynamic Safety. Importance of Aerodynamic Safety in Aviation, H. F. Guggenheim. Mech. Eng., vol. 49, no. 7, July 1927, pp. 719-732, 4 figs. What is meant by safety in aviation; flying hazards and how they are being overcome; Daniel Guggenheim Safe Aircraft Competition and its object; safety tests and demonstrations of competition and basis of award of prize.

Transportation Costs. Economic Characteristics of Aerial Transportation (Caratteristiche economiche del trasporto aereo), E. G. Luraghi. Rivista Aeronautica, vol. 3, no. 5, May 1927, pp. 93-99, 2 figs. Comparative analysis of fixed charges and operating costs of transportation by air, rail, water; list of principal European air lines, showing saving in time of travel.

B

BALANCING MACHINES

Dynamic. Dynamic Balancing Machine. Engineering, vol. 124, no. 3207, July 1, 1927, pp. 25-26, 6 figs. Avery-Linley machine for balancing crankshaft dynamically.

BEARINGS

Anti-Friction. Requirements of Anti-Friction Bearings for High-Speed Use, D. E. Batesole. Am. Mach., vol. 66, no. 26, June 30, 1927, pp. 1075-1077, 10 figs. Retainer design for ball and cylindrical roller bearings; workmanship; mounting design features of grinding spindles, portable air-turbo grinder and airplane superchargers; lubrication.

Oil Grooves in. Semi-Annular Grooves in Bearings Urged as Lubrication Aid, H. L. Newton. Automotive Industries, vol. 57, no. 2, July 9, 1927, pp. 54-56, 3 figs. High pressure in oil required when bearings are lubricated through radial hole in journal and outlet of hole registers with bearing groove for only small fraction of revolution.

Split, Machining. Machining Split Bearings. Machy. (Lond.), vol. 30, nos. 763 and 764, May 26 and June 2, 1927, pp. 244-246 and 265-268, 16 figs. May 26: Reviews machining methods which have come to notice, and outlines method writer has adopted to eliminate disadvantages of methods reviewed, and so increase production and obtain more accurate bearings at lower cost. June 2: Method and fixtures recommended.

BELT DRIVE

Short-Centre. Solving the Problems of Short-Centre Drives, W. Staniar. Indus. Mgmt. (N.Y.), vol. 74, no. 1, July 1927, pp. 15-20, 14 figs. Various means of securing efficient power transmission where space is limited.

BLAST FURNACES

Oxy-Acetylene Applied to. Iron Blast Furnaces. Iron & Steel of Can., vol. 10, no. 5, May 1927, pp. 140-145, 13 figs. It is in maintenance of mechanical equipment that oxy-acetylene process finds its most diverse uses; blowing in with oxygen.

BOILER FEEDWATER

Impurities. Impurities in Feed Water and Their Effect on Boiler Operation, J. B. Romer. Power, vol. 66, no. 1, July 5, 1927, pp. 32-33. Minerals in boiler water; effects of various minerals on boiler operation; corrosion. Abstract of paper read before Am. Water Works Assn.

Oxygen Recorder. An Instrument for Recording Dissolved Oxygen in Feed Water. Eng. & Boiler House Rev., vol. 40, no. 12, June 1927, pp. 621-624, 2 figs. Patent recorder is robust boiler-house instrument which records percentage of oxygen on chart calibrated in cubic centimeters per liter of water, and thus enables defects in feedwater system to be instantly detected.

Treatment. Feedwater Treatment. Elec. West, vol. 58, no. 6, May 15, 1927, pp. 389-392. Methods employed by Southern Pacific Co.; Mare Island navy yard; Great Western Power Co.; Pacific Gas & Electric Co.; Southern California Edison Co.; Long Beach steam plant; Los Angeles Gas & Electric Corp.; San Joaquin Light & Power Corp. Prime Movers' Committee report to Pac. Coast Elec. Engrs.

BOILER FIRING

Oils and Gaseous Fuels. Burning of Liquid and Gaseous Fuels. Elec. West, vol. 58, no. 6, May 15, 1927, pp. 392-395, 1 fig. Water-cooled walls and air preheaters and their effect upon combustion of oil and gas; comparison, from operating standpoint, of two different oil and gas burners; prevention of pulsation in operation of mechanical atomizing burners under natural draught. Prime Movers' Committee report to Pac. Coast Elec. Engrs.

BOILER FURNACES

Developments. Recent Developments in Boiler Furnaces, B. N. Broido. Eng. Jl., vol. 10, no. 7, July 1927, pp. 333-344, 29 figs. Review of design of various types; stoker development; introduction of powdered fuel; water-cooled furnace walls; radiation in boiler furnaces; heat absorption by radiation; preheated air; difference in operation with and without water walls; insulation of water-cooled walls; air-cooled brick walls for furnaces; furnace control.

Pulverized Coal. Powdered Fuel Combustion and Furnace Design, T. A. McGee. Paper Trade Jl., vol. 84, no. 22, June 2, 1927, pp. 81-82. Selection of coal; percentage of fixed carbon; combustion rates and furnace volumes; increase in heat liberation; furnace-water cooling; four types of construction.

Pulverized Coal Furnace and Firing Problems, A. G. Christie. Power Plant Eng., vol. 31, no. 13, July 1, 1927, pp. 716-718. Unit pulverizer practice, turbulent burners, drying methods, furnace walls and ash-pit construction are matters for study.

BOILER OPERATION

Problems. Operation Problems Encountered in Boiler Operation at Omaha, C. F. Turner. Mech. Eng., vol. 49, no. 7, July 1927, p. 762. Deals with stoker drives, economizers, slagging and sizing and tempering coal.

BOILER PLANTS

American Practice. American Boiler House Practice as Seen by a British Engineer. Eng. & Boiler House Rev., vol. 40, no. 12, June 1927, pp. 605-606. Impressions gained at American power plants; high- and super-pressures; experimental work; mechanical stokers.

Automatic Control. Automatic Control in the Boiler House. Eng. & Boiler House Rev., vol. 41, no. 1, July 1927, pp. 15-22 and 40, 8 figs. Details of German installation of automatic control gear fitted to boilers of railway repair shops at Cassel. Translated from articles by Oberbeck in Wärme.

Instruments. Boiler Room Instruments, D. Henderson. Combustion, vol. 17, no. 1, July 1927, pp. 27-30. Deals with CO_2 recorder and flue-gas thermometer, flow meters, etc.

Instruments for Boiler Room and Turbine Room. Elec. West, vol. 58, no. 6, May 15, 1927, pp. 385-388, 9 figs. Comprehensive survey of instruments used by member companies. Prime Movers' Committee report to Pac. Coast Elec. Assn.

Railway Shops. New Plant Helps Reduce Railroad Costs. Power Plant Eng., vol. 31, no. 13, July 1, 1927, pp. 727-728, 4 figs. Simple, rugged coal and ash-handling system installed with new boiler plant for railroad shops.

BOILER PLATE

Embrittlement. Embrittlement of Boiler Plate, S. W. Parr and F. G. Straub. Indus. & Eng. Chem., vol. 19, no. 5, May 1927, pp. 620-622, 5 figs. Investigation undertaken by Engineering Experiment Station of University of Illinois in co-operation with group of public utilities of Middle West for purpose of obtaining information of general interest to all; cause of intercrystalline failures; prevention of embrittlement.

BOILERS

Blowdown. Automatic Boiler Blowdown in Proportion to Moisture Content of Steam, W. J. Hughes. Power, vol. 66, no. 1, July 5, 1927, pp. 13-16, 5 figs. To maintain continuously proper relation between boiler-water condition and load, author proposes to use, in addition to steam purification, automatic boiler blowdown, in proportion to moisture in steam, at considerable saving over hand or continuous blowdown.

Drums. Forged Drums Promote Safety at High Pressure, J. L. Cox. Power Plant Eng., vol. 31, no. 14, July 15, 1927, pp. 771-774, 8 figs. Boiler drums forged without seams from single ingot give strength of walls equal to that of metal itself, and there is no limit to wall thickness, except as imposed by weight.

Electrically-Welded Straps. Electrically-Welded Reinforcing Straps on Boilers and Containers, E. Horn. Mech. Eng., vol. 49, no. 7, July 1927, pp. 731-734, 11 figs. Particulars regarding early investigations conducted in Switzerland contributed by author as supplement to his article on autogenously and electrically welded boilers and containers, published in June 1926 issue of this journal.

Gasification and Combustion. Total Gasification and Combustion for Steam Boilers, D. Brownlie. Eng. & Boiler House Rev., vol. 41, no. 1, July 1927, pp. 23-27, 2 figs. Details of two methods for gasifying fuels and burning gases direct under boilers for even smallest units, that is, "Wollaston" process and "Gasifuel" process, latter being applicable also to "Lancashire" boilers.

Mountings and Fittings. Modern Steam Boiler Mountings and Fittings. Eng. & Boiler House Rev., vol. 41, no. 1, July 1927, pp. 3-14, 15 figs. Review of some of principal mountings and fittings used in modern boiler practice.

Scale, Effect on Heat Transmission. What Scale Does to Boiler Heat Transmission Coefficients, H. O. Croft. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 7, July 1927, pp. 435-439, 1 fig. Attempt to analyze boiler heat-transmission problem as a whole and to indicate relative importance of scale formation as one of constituent factors.

Scale Removal. Boiler Scale Prevention by an Entirely New Method. Eng. & Boiler House Rev., vol. 40, no. 12, June 1927, pp. 628-630. Process, known as "Etherium" scale-treatment method, consists of specially prepared compound, which is placed inside sealed metal canisters, and these canisters are placed in feedwater tank.

Steam Heating. The Code for the Rating of Low Pressure Solid Fuel Steam Heating Boilers. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 7, July 1927, pp. 440-441. Gives rating code, to give a measure of capacity, all other considerations being secondary; its purpose is to resolve present chaos in ratings of heating boilers.

Vertical Bent-Tube. A Step in Advance in Vertical Bent Tube Boiler Design, B. W. Bach. Universal Engr., vol. 45, no. 6, June 1927, pp. 23-25, 1 fig.

Waste-Heat. Modern Waste-Heat Boiler Developments, A. J. Ebner. Combustion, vol. 16, no. 6, June 1927, pp. 329-332, 4 figs. Development and requirements of waste-heat boilers; typical installation.

BOILERS, WATER-TUBE

Priming. Priming in Cross-Drum Water-Tube Boilers, A. Bement. Power, vol. 66, no. 2, July 12, 1927, pp. 56-57, 4 figs. Use of baffling in drum to eliminate tendency of cross-drum water-tube boiler at high rates of evaporation to discharge water with outgoing steam.

BRAKES

Specifications. Report on Brakes and Brake Equipment. Ry. Age, vol. 82, no. 28, June 11, 1927, pp. 1814-1819, 5 figs. Report of Committee to Am. Ry. Assn.

BRASS

Sulphur in. Sulphur in Brass. Foundry Trade Jl., vol. 35, no. 564, June 9, 1927, p. 487. Sulphur and rolling troubles; it has been repeatedly demonstrated that of all different impurities present while working brass, sulphur is apparently least likely to cause trouble.

BRIDGES. CONCRETE

Abutments. The Design of the Abutments of Girder Bridges. A. C. Hughes and C. S. Gray. Surveyor (Lond.), vol. 71, nos. 1832 and 1844, Mar. 4 and May 27 . pp. 263-264 and 523-525, 13 figs. Mar. 4: Not only must scour from stream as it is at time of building of bridge be considered, but any possible changes in direction of flow or bed of stream must also be investigated. May 27: Example of design of mass concrete abutment.

Arch Construction. Arch Construction with Mass Concrete (La construccion de bovedas con hormigon en masa), C. Pabon. Revista de Obras Publicas, vol. 75. no. 3, Feb. 1, 1927, pp. 47-50. 5 figs. Design and methods of construction of bridge arches 21.6 to 23.2 m. in span; details of original temporary centring.

Highway. Proposed New Road Bridge Across the Menai Straits. Engineering, vol. 174. no. 3207. July 1, 1927, pp. 8-9. 11 figs. Details of replacement of Telford's suspension bridge: new design provides clear headway at high water of 80 ft. for width of 460 ft.; it will consist essentially of two arched ribs of reinforced concrete.

BRIDGES. LIFT

Bascule. Tests on the Bearing of Large Rollers, W. M. Wilson. Univ. of Ill. Bul., vol. 24, no. 30, Mar. 29, 1927, 73 pp., 47 figs. Object of investigation was to obtain data on which to base design of rolling bascule bridges; load that cylinder lying on plane surface can safely carry depends upon many factors; tests made in connection with investigation were planned to determine influence of number of these factors, ones whose effect was studied being diameter of segment, length of segment measured in direction parallel to axis of cylinder, method of manufacture (steel castings and steel forgings), hardness of material as controlled by composition of steel and hardness of material as controlled by heat treatment.

New Latch for Bascule Bridges, C. E. Paine. Can. Engr., vol. 52, no. 23, June 7, 1927, pp. 577-578. 5 figs. New type of lock developed to improve method of seating and locking bridges: latches automatically as leaf reaches fully closed position.

BRIDGES, HIGHWAY

Steel. Keewatin Bridge Built by Ontario Department of Northern Development, J. S. Leitch. Contract Rec., vol. 41, no. 24, June 15. 1927. pp. 598-603. Modern steel-truss structure on Winnipeg-Fort William highway: two unequal spans on concrete abutments and centre pier; concrete poured in below zero weather.

BRIDGE STRENGTHENING

Electric Welding. Electric Welding Reduces Cost of Strengthening Bridge. Ry. Eng. & Maintenance, vol. 23, no. 7. July 1927, pp. 279-281, 4 figs. Chicago Great Western avoids much drilling and riveting in applying reinforcing plates to Leavenworth structure.

BRONZES

Machining. The Machining of Special Bronzes. Metal Industry (N.Y.). vol. 25, no. 6, June 1927, p. 249. Suggestions for working of different alloys.

BRUSHES

Interpole Machines. How to Locate the Correct Position of Brushes on Interpole Machines, C. O. Mills. Power. vol. 65, no. 26. June 28. 1927, pp. 987-989, 7 figs. Methods employed of checking position after machine goes into operation.

BUILDING CONSTRUCTION

Rolled Structural Section. A Recent Development of Rolled Structural Sections, A. E. Crockett. Engrs'. Soc. West. Pa.—Proc., vol. 43. no. 1. Feb. 1927, pp. 27-44 and (discussion) 44-51, 11 figs. Abstract of Prof. Ketchum's report of tests planned to develop such properties of light I-beams as would make it possible to compare these beams with I-beams of standard section; tests for strength under vertical flexure; sidewise buckling of compression flange; resistance to failure by compression of web over bearing block and for resistance to diagonal buckling of web.

Steel Skeleton Type. Evolution of the Steel Skeleton Type of Building, R. Fleming. Engrs'. Soc. West. Pa.—Proc.. vol. 43. no. 1. Feb. 1927, pp. 1-25 and (discussion) 25-26. Discusses main factors which have made skeleton type of high building practicable. namely, rolled iron beam. passenger elevator, tile flat-arch floor construction. namely, rolled iron beam, passenger elevator, which is discussed.

C

CASE HARDENING

Oil Fuel for. Oil Fuel for Carburizing, A. J. Smith. Petroleum Times, vol. 17, no. 441. June 25, 1927, pp. 1207-1208 and 1210. Results obtained in conjunction with continuous operation.

CASTING

Centrifugal. Centrifugal Tube Casting in Hot Moulds, L. Cammen. Foundry Trade Jl., vol. 35, no. 565, June 16, 1927, pp. 501-502. Abstract of paper read before Foundrymen's Assn. in 1926. Materials for heated moulds; experiment to develop mould material; protecting mould surface from solvent action of hot steel; temperature of hot moulds.

Machine. Machining Casting with Lobe-Shaped Bore, J. E. Fenno. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 818-820. Fixtures and tools designed for machining operations on exhaust-pump casings.

CASTINGS

Cleaning and Grinding. Cleaning and Grinding Casting. Iron Age. vol. 119, no. 26, June 30, 1927, pp. 1886-1889, 5 figs. Arrangement of tumbling barrels and their drive; gravity carries to grinding machine; methods at foundry for washing-machine factory of Maytag Co., Newton, Iowa.

CAST IRON

Heat Treatment, Effect of. Effect of Heat Treatment on the Combined Carbon in Grey Cast Iron, E. L. Roth. Am. Soc. Steel Treating—Trans., vol. 12, no. 1, July 1927, pp. 27-40, 13 figs. Results of series of experiments.

Shrinkage. Some Aspects of Foundry Work, E. Longden. Foundry Trade Jl., vol. 35, nos. 563 and 564. June 2 and 9. 1927, pp. 463-465 and 475-480, 32 figs.

CENTRAL STATIONS

High-Pressure. Steam Station Development in the Middle West, F. S. Collings. Mech. Eng., vol. 49, no. 7, July 1927, pp. 759-762, 6 figs. Outstanding points of interest and principal factors involved, it being assumed that there is available a suitable site, necessary railroad facilities, adequate supply of circulating water for condensers. fuel and source of reasonably good water for boiler-feed make-up. See also Power House, vol. 21, no. 11, June 5, 1927, pp. 28-30, 6 figs.

Interconnection. An Interconnector Study, S. A. Stigant and M. Lacey. Elec. Times, vol. 71, no. 1858, June 2, 1927, pp. 767-769, 7 figs. After having made careful and prolonged study of available literature, authors have been impressed with absence of clear and simple diagrams explaining exactly what is involved in term "synchronizing power" of station interconnector and also with way in which effects of variations of different interconnector characteristics governing flow of power and wattless currents have been left largely to mercies of definitions; attempt is here made to remdy this omission.

Isolated Plants. Isolated Plant Business Proves Highly Profitable, W. P. Bear. Elec. World, vol. 90, no. 2, July 8, 1927, pp. 67-69. Central station service displaces 12,918 h.p. during 1926; methods of obtaining business; returns per man prove greater than other classes of business.

CITY PLANNING

Vancouver. Town Planning Problems in Vancouver, A. G. Dalzell. Can. Engr., vol. 52, no. 25, June 21, 1927, pp. 616-618. Present conditions and improvements which would result if city were properly planned.

CLAY

Mining. Turning Mine Waste into Profits, H. E. Nold. Brick & Clay Rec., vol. 80, no. 1, July 5, 1927, pp. 37-40, 5 figs. System of clay mining which recovers greatest possible amount of clay from deposit.

COAL

Briquetting. Fuel Briquets, F. G. Tyron. U.S. Bur. of Mines—Mineral Resources, June 20, 1927, pp. 1-8. Production; number of plants in operation; capacity of plants, raw fuel, binders, plants operated in 1926, foreign trade in briquets, world's production.

By-Product Processing. The By-Product Processing of Coal. Mech. Eng., vol. 49, no. 7, July 1927, pp. 741-745. Discussion of three papers by A. C. Fieldner, Wm. H. Blauvelt and R. S. McBride, published in mid-November 1926 issue of this journal, dealing with fundamental technology of gaseous fuel supply, principles involved in high- and low-temperature coal carbonization processes, possibilities of processes available, etc.

Carbonization. Low Temperature Carbonization in Holland, D. Brownlie. Gas Age-Rec., vol. 59, no. 25, June 18, 1927, pp. 889-890, 3 figs.

Distillation. Low-Temperature Distillation of Coal (Notes sur la distillation à basse temperature du charbon). Revue de l'Industrie Minérale, no. 148, Feb. 15. 1927, pp. 75-88.

Treatment. The Coal Treatment Laboratory, Birmingham University. Engineering, vol. 123, no. 3206, June 24, 1927, pp. 753-755, figs. on supp. plates. Indication of work it is proposed to do in laboratory; deals with its general arrangement and describes equipment which is installed in it.

COAL HANDLING

Central Stations. Coal Handling at Dresser Station, H. M. Sharp. Power Plant Eng., vol. 31, no. 12, June 15, 1927, pp. 685-687, 3 figs. Equipment and methods of handling coal and ash at mine plant.

New Coal Handling System Enlarges Facilities, O. S. Richardson. Power Plant Eng., vol. 31, no. 14, July 15, 1927, pp. 791-793, 3 figs. New equipment at Eddy Street Station works with or independent of old system to meet demands of recent additions.

COAL MINES

Electricity in. The Use of Electricity for Underground Working Mines Subject to Firedamp (L'emploi de l'électricité dans les travaux souterrains des mines grisouteuses), E. Audibert. Société Française des Electriciens—Bul., vol. 7, no. 68, Apr. 1927, pp. 398-417. In France, use of electricity in such mines has hitherto been forbidden, but French government has decided to revise their regulations. See abstract in Génie Civil, vol. 90, no. 12, Mar. 19, 1927, pp. 298-299, and English abstract in World Power, vol. 7, no. 42, June 1927, pp. 294-295.

Nova Scotia. Some Causes of Decline in Individual Productivity in Nova Scotia Collieries, F. W. Gray. Can. Min. Jl., vol. 48, no. 24. June 17, 1927, pp. 495-496. Chief hindrance to prosperity of Nova Scotia coal mines for 12 years past has been shortage of coal miners.

COAL MINING

Undersea. Mining Coal Under the Sea in Nova Scotia, with Notes on Comparable Undersea Coal Mining Operations Elsewhere, F. W. Gray. Can. Min. & Met. Bul., no. 182, June 1927, pp. 638-758, 15 figs. Deals chiefly with undersea coal mining in Nova Scotia, but attempt is made to summarize development of mining practice in winning of undersea coal in other parts of world.

COKE

Combustibility. The Combustibility of Coke, W. Diamond. Foundry Trade Jl., vol. 35, no. 562, May 26, 1927, pp. 448-450. Recovery coke ovens: structural strength of coke; cupola; volume and pressure of blast.

Statistics, 1924. Coke and By-Products in 1924, F. G. Tryon. U.S. Bur. Mines—Mineral Resources, no. II:31, May 20, 1927, pp. 591-728. Contains following contributions: Coke and By-Products, F. G. Tryon and others; Marketing of Coal Products: A Discussion of Some Economic and Technical Principles Which Should Guide in the Disposal of the Primary Products of Coal Carbonization, R. S. McBride; statistical summary; production by furnace and non-furnace ovens; production by states and districts; number and type of ovens.

COLD STORAGE

Fruit. Studies of the Optimum Cold Storage Temperatures for Fruit, E. L. Overholser. Ice & Refrigeration, vol. 73, no. 1, July 1927, pp. 26-29. Information on effect of temperatures on various developments in fruits from picking through storage.

Plants. An Interesting Cold Storage Installation. Ice & Refrigeration, vol. 73, no. 1, July 1927, pp. 14-16, 8 figs. New plant of Diamond Cold Storage Co., Wilmington, Del.; modern equipment throughout, platforms conveniently arranged for quick and easy loading of railroad cars or trucks; details of piping and insulation and refrigerating equipment.

COMBUSTION

Control. Combustion Control from Operator's Viewpoint, W. C. Holmes. Combustion, vol. 17, no. 1, July 1927, pp. 36-39, 5 figs. Combustion control at Hudson Avenue station; control for 400-lb. boilers.

Experiences with Automatic Combustion Control, A. S. Davis. Combustion, vol. 17. no. 1, July 1927, pp. 33-36, 5 figs. As result of experience, it is felt that automatic control of primary air is not necessary; occasional adjustments of this air supply to proportion it to larger changes in load is all that is necessary, and automatic control of it would only result in increased complexity of apparatus without purpose.

COMPASSES

Earth Inductor. The Pioneer Earth Inductor Compass, M. M. Titterington. Aviation, vol. 22, no. 25, June 20, 1927, pp. 1356-1357 and 1400, 1 fig. Its characteristics, construction, operation and advantages to aerial navigator.

CONCRETE

CURING. Apparatus for Curing Concrete, L. D. Barrows. Can. Engr., vol. 52, no. 21, May 24, 1927, pp. 543-544. Method employed by Maine for incorporating calcium chloride in concrete mix; used with any type of mixer.

MOISTURE TEST. Moisture, Voids, Specific Gravity Determined Rapidly, C. M. Chapman. Concrete Products, vol. 32, no. 6, June 1927, p. 62. To meet some of objections that have been raised to making field tests of voids or moisture, a new type of test has been devised which permits determination of surface moisture or voids or apparent specific gravity of a fine aggregate to be made in a few minutes in field with simple and inexpensive apparatus.

WATER CEMENT RATIO. Influence of the Water Cement Ratio on the Strength of Concrete, F. R. McMillan. Contract Rec., vol. 41, no. 22, June 1, 1927, pp. 554-555, 1 fig. Explanation of tests at Research Laboratory of Portland Cement Assn. See also Can. Engr., vol. 52, no. 23, June 7, 1927, pp. 574-575, 2 figs.

CONCRETE CONSTRUCTION, REINFORCED

WAREHOUSES. New Terminal Warehouse at Montreal, A. C. Hammond. Can. Engr., vol. 52, no. 22, May 31, 1927, pp. 555-557, 3 figs. Ten-storey reinforced concrete structure for Montreal rail and water terminals. See also description in Contract Rec., vol. 41, no. 23, June 8, 1927, pp. 576-580, 10 figs.

CONCRETING

BUILDINGS. Concrete Plant for Terminal Warehouse, J. J. Shea. Can. Engr., vol. 52, no. 23, June 7, 1927, pp. 567-569, 2 figs. Arrangement of plant used in construction of terminal warehouse for Canadian Rail and Harbour Terminals, Ltd., at Toronto, results in rapid progress of concrete work; record pour was 1,186 cu. yd. of concrete in one day.

CONDENSERS, STEAM

ECONOMICAL DESIGN. Selecting the Most Economical Condenser, J. A. Powell and H. V. Vetlesen. Power Plant Eng., vol. 31, no. 12, June 15, 1927, pp. 672-673, 5 figs. Inlet temperature of circulating water, velocity of water in tubes, tube arrangement and design of condenser are details which must be considered when making study of best condenser to be used. Abstract of paper presented before Am. Soc. Mech. Engrs., Philadelphia.

OPERATION AND MAINTENANCE. Operation and Maintenance of Condensing Equipment. Elec. West, vol. 58, no. 6, May 15, 1927, pp. 379-384, 8 figs. Analyzes problems of condenser operation, particularly those over which operator has control to certain extent, such as operation of circulating pumps, cleaning of tubes and prevention and location of air and tube leaks. Prime Movers' Committee report to Pac. Coast Elec. Assn.

PERFORMANCE. Steam Condenser Performance, D. G. McNair. Colliery Eng., vol. 4, no. 39, May 1927, pp. 198-200, 3 figs. Effects of changing conditions on vacuum obtained in steam condensers.

CONNECTING RODS

MANUFACTURE. Connecting Rod Manufacturing Methods, A. F. Denham. Automotive Industries, vol. 57, no. 2, July 9, 1927, pp. 41-45. Much variation in methods used by important car makers, despite standardization of some phases of process.

CONVEYORS

FOUNDRIES. Savings from the Use of Conveyors in Manufacturing. Iron Age, vol. 120, no. 1, July 7, 1927, pp. 1-5, 8 figs.

PNEUMATIC. The "Pneuconex" Pneumatic Conveyor System. Machy. Market, no. 1388, June 10, 1927, pp. 21-23, 4 figs. System includes special section of piping, tangential method of introducing material, self-closing collecting nozzles, special bends and junctions, controlling valves, automatic gravity-operated dischargers, new type of rotary exhauster.

PROGRESSIVE PRODUCTION. Handling Devices and Progressive Manufacturing Processes, Wolther. Indus. Mgmt. (Lond.), vol. 14, no. 6, June 1927, pp. 197-201, 10 figs. Handling devices employed in progressive-production processes. Translated from Fördertechnische Rundschau.

COOLING TOWERS

RIVER WATER VS. River Water vs. Cooling Towers (Le choix entre l'eau de rivière et les réfrigérants de condensation pour les centrales thermiques), T. J. Gueritte. Génie Civil, vol. 90, no. 15, Apr. 9, 1927, pp. 366-367. Summarizes reasons for using cooling towers for condensing water instead of drawing continual fresh supply of water from river; recent advances in construction of cooling towers. See brief translated abstract in Power Engr., vol. 22, no. 255, June 1927, p. 234.

COPPER METALLURGY

LEACHING. Leaching Copper Calcine, A. T. Fry. Chem. Eng. & Min. Rev., vol. 19, no. 224, May 5, 1927, pp. 279-282. Vacuum filtration; percolation; specific gravity of solutions; leaching equipment; immersion heaters; electrodes.

CORE OVENS

ELECTRIC. Core Baking by Electric Heat. Iron Age, vol. 120, no. 1, July 7, 1927, p. 18. Electrically heated core ovens of Edition Electric Illuminating Co., Boston, used for cores varying from less than an ounce to as much as 400 lb. each, required in making intricate castings used in manufacture of laundry machinery.

CORROSION

CAUSES AND PREVENTION. Corrosion, Its Causes and Prevention, C. E. Texter. Power, vol. 66, no. 1, July 5, 1927, pp. 33-34. Theory of corrosion; factors that are becoming more severe; boiler-water treatment. Abstract from paper presented at Nat. Board of Boiler and Pressure Vessel Inspectors.

COST ACCOUNTING

WORKING HOURS AND OVERHEAD. Working Hours and Oncosts, A. Whitehead. Machy. (Lond.), vol. 30, no. 765, June 9, 1927, pp. 293-295, 2 figs. Effects of fatigue and of time of starting on work; variations in cost under different working conditions; unit cost variation in relation to hours worked; advantages and disadvantages of night shift.

CRANES

ACCIDENTS. Mechanical Causes of Crane Accidents, M. C. Goodspeed. Safety Eng., vol. 53, no. 6, June 1927, pp. 253-255. Calls attention to outstanding parts of crane which frequently fail.

CRANKSHAFTS

BUILT-UP. An Interesting Crankshaft. Automobile Engr., vol. 17, no. 229, June 1927, pp. 225-226, 2 figs. Novel constructional methods on component designed by A. C. (Acedes) Cars; each web is disk with journal or pin forged integral with it; there are 12 such disks, that at forward end carrying spigot or supercharger drive, while rear one carries taper or attachment of flywheel.

CUTTING METALS

UNDER WATER. Cutting Metals Under Water, L. F. Hagglund. Am. Welding Soc.—Jl., vol. 6, no. 5, May 1927, pp. 51-54, 5 figs. Method of cutting by means of electric arc and oxygen; combines heat of electric arc, together with oxidizing effect of stream of gaseous oxygen; method has been used successfully at various depths down to 120 ft. to cut steel plate, sheet piling, cast steel, cast iron, copper and brass.

D

DAMS

GRAVITY. Shaver Lake Dam. West. Constr. News, vol. 2, no. 12, June 25, 1927, pp. 36-38, 6 figs. Stevenson creek, San Joaquin river watershed, California; part of Big Creek hydro-electric development of Southern California Edison Co.; it is gravity-type dam 183 ft. high above bedrock.

DIE CASTING

ALUMINUM. Notes on Aluminum Die Casting, F. A. Livermore. Metal Industry (Lond.), vol. 30, no. 23, June 10, 1927, pp. 571-572. Die casting machines; dies, alloys; method of die casting.

DIES

LAMINATIONS, MANUFACTURE OF. Dies for Producing Laminations, P. J. Edmonds. Machy. (N.Y.), vol. 33, nos. 10 and 11, June and July 1927, pp. 749-754 and 829-832, 10 figs. Design, construction and application of dies for manufacturing laminations used in electrical apparatus.

DIESEL ENGINES

ACRO. The Acro Diesel Engine, R. Stribeck. Engineering, vol. 123, nos. 3204 and 3206, June 10 and June 24, 1927, pp. 699-701 and 779-781, 13 figs. Essential characteristic of engine is peculiar compression space consisting of three separate parts, design of which and its subdivision was developed by inventor, F. Lang; results of tests; exceedingly difficult problem of mixing fuel with air is practically non-existent in case of this engine, and mixture is formed quite incidentally in course of combustion. Translated from German.

AUTOMOTIVE. Development of the High-Speed Diesel Engine, P. M. Heldt. Soc. Automotive Engrs.—Jl., vol. 21, no. 1, July 1927, pp. 87-89, 18 figs.

Diesel Motors for Automobiles, H. Triebnigg. Oil Eng. & Technology, vol. 8, no. 6, June 1927, pp. 224-225. Abstracted from Technische Blatter, May 28, 1927.

COST AND TEST DATA. Oil Engine Cost and Test Data. Power Plant Eng., vol. 31, no. 12, June 15, 1927, pp. 675-677, 3 figs. Installation costs and operating data of Diesel and semi-Diesel engines.

COSTS. Diesel and Semi-Diesel Engine Costs, E. R. Mellenger. Can. Engr., vol. 52, no. 23, June 7, 1927, pp.579-581, 2 figs. Comparison between initial and operating costs of Diesel and semi-Diesel engines; comparative costs of fuel for oil, gas and steam engines; heat recovery on Diesel engines; exhaust-gas turbine.

INSPECTION AND UPKEEP. Instructions and Recommendations for the Inspection and Upkeep of Diesel Engines (Instructions et recommandations concernant la visite et l'entretien des moteurs Disel). Bul. Technique du Bureau, Veritas, vol. 9, no. 2, Feb. 1927, pp. 21-25.

LIGHT SUPERCHARGED. The Light Supercharged Diesel Engine for Use in Air Service, E. A. Sperry. Mech. Eng., vol. 49, no. 7, July 1927, pp. 723-726. Particulars of author's proposal to reduce Diesel engine weight per horse power below that of gasoline engines by employment of high supercharging, and to eliminate fire risk from flying by use of Diesel engines running on cheap, low-volatile fuel oil.

DRILLING MACHINES

COMBINED MEASURING AND. Société Génevoise Combined Measuring and Drilling Machine. Am. Mach., vol. 66, no. 26, June 30, 1927, p. 1112. Machine that combines means for accurate measurement with facilities for drilling and boring of holes in master plates or parts of small machines and instruments.

DURALUMIN

CORROSION. Effect of Corrosion Upon the Fatigue Resistance of Thin Duralumin, R. R. Moore. Am. Soc. Testing Matls.—Advance Paper, no. 37, for mtg. June 20-24, 1927, 7 pp., 5 figs.

SPOT-WELDED. Tension Tests of Spot-Welded Duralumin, T. W. Downes. Chem. & Met. Eng., vol. 34, no. 6, June 1927, pp. 359-360, 4 figs. Deals principally with tension and corrosion tests of electric spot-welded specimens of sheet duralumin which have been conducted at Naval Aircraft Factory; heat treatment of specimens; character of welds.

E

EDUCATION, ENGINEERING

TRENDS. Trends in Engineering Education, A. A. Potter. Ry. Mech. Engr., vol. 101, no. 7, July 1927, pp. 427-428. Engineering as it affects national prosperity; industry and engineering colleges are interdependent; engineering education in the United States and Canada.

EDUCATION, INDUSTRIAL

COLLEGE GRADUATES. Industrial Training for College Graduates, S. C. Coler. Soc. Indus. Engrs.—Bul., vol. 9, nos. 5-6, May-June 1927, pp. 25-26. General aspects of industrial training programme; Westinghouse programme.

ELECTRIC FURNACES

INDUSTRIAL. Industrial Electric Furnaces in the First Quarter of the Century (Il forno elettrico industriale nel primo quarto del secolo), S. Pagliani. Elettricista, vol. 36, no. 6, June 1927, pp. 81-87, 8 figs. Deals with electrometallurgical furnaces; arc furnaces of Stassano and Heroult types.

ELECTRIC WELDING, ARC

GEARS. Making Gears by Arc Welding. Welding Engr., vol. 12, no. 6, June 1927, pp. 39-42, 6 figs. Radical change in appearance is only an incident in change from cast gear blanks to gear blanks made of welded steel; more important features of two types of gears are compared.

PLATES AND STRUCTURAL SHAPES. Welded Parts Take the Place of Castings, C. O. Herb. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 861-865, 9 figs. Fabrication of plates and structural shapes into machine members by arc welding.

STRUCTURAL STEEL. The Welding of Steel Structure. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 825-827, 3 figs. Design fabrication, erection and cost of five-storey shop, 70 ft. wide, 220 ft. long. Abstract of paper read before Am. Iron & Steel Inst.

TANK CONSTRUCTION. Arc Welding Speeds in Tank Construction, R. E. Kinkead. Boiler Maker, vol. 28, no. 6, June 1927, p. 177, 3 figs. Use of proper electrodes at higher heats for any given work accomplishes gain in speed of manual operation.

ELECTRIC WELDING, RESISTANCE

SEAM. Seam Welding, W. H. Gibb. Am. Welding Soc.—Jl., vol. 6, no. 5, May 1927, pp. 55-64, 16 figs. Term "seam welding" is applied to that process of resistance welding by which overlapped edges of two pieces of sheet metal are joined in continuous weld, without addition of any other metal; advantages of process.

TRUCK WHEELS. Resistance Welding Truck Wheels, W. Remington. Am. Welding Soc.—Jl., vol. 6, no. 5, May 1927, pp. 64-73, 10 figs. Welding of Bethlehem rolled steel truck wheel.

ELECTRICAL EQUIPMENT

GROUNDING. Grounding for Service and Safety, E. M. Wood. Elec. News, vol. 36, no. 12, July 1, 1927, pp. 32-40, 13 figs. Comprehensive discussion advising best practice; many results on different grounds; testing and maintenance.

ELECTRICAL MACHINERY

HEATING-TIME CONSTANT. Heating-Time Constants: Their Variation in Forced Cooled Machinery, D. H. Wills. World Power, vol. 8, no. 43, July 1927, pp. 25-28, 2 figs. Considers variable nature of heating-time constant for forced cooled machinery from theoretical considerations, and gives results of tests on an alternator and transformer confirming theory.

ELECTRICAL MEASUREMENTS

HIGH-FREQUENCY. Symposium on High-Frequency Measurements, Pittsfield, Mass., May 25-28, 1927, issued by Am. Inst. of Elec. Engrs. Contains following papers: Notes on Use of Radio-Frequency Voltmeter, W. N. Goodwin; Substitution Method for Determination of Resistance of Inductors and Capacitors at Radio Frequencies, C. T. Burke; Condenser Shunt for Measurement of High-Frequency Currents of Large Magnitude, A. Nyman; Radio-Frequency Current Transformers, P. MacGahan; Methods for Measurement of Radio Field Strengths, C. R. Englund and H. T. Friis; Quantitative Determination of Radio Receiver Performance, H. D. Oakley; High-Frequency Measurements of Communication Lines, H. A. Affel and J. T. O'Leary; Measuring Insulation of Telephone Lines at High Frequencies, E. I. Green; High-Frequency Measurements of Communication Apparatus, W. J. Shackelton and J. G. Ferguson; Impedance of Non-Linear Circuit Element, E. Peterson; Empirical Analysis of Complex Electric Waves, J. W. Horton; A. New Thermionic Voltmeter, S. C. Hoare; The Oscilloscope, Stabilized Cathode-Ray Oscillograph with Linear Time Axis, F. Bedell and H. J. Reich; Sensitivity Characteristics of Low-Frequency Bridge Network, P. G. Edwards and H. W. Herrington; Microammeter Indication of High-Frequency Bridge Balance, H. M. Turner.

INDUCTANCE. A Direct-Reading Inductance Standard, J. C. Vogel. Bell Laboratories Rec., vol. 4, no. 5, July 1927, pp. 399-402, 4 figs. Manufacture of loading coils needed each year by Bell System requires about two and a half million measurements of inductance, for which testing equipment is necessary giving high degree of accuracy with but short period for individual test; testing set consists of bridge unit and inductance standard; latter in turn contains in series four coils of fixed inductance continuously variable inductance called inductometer and variable resistance.

ELECTRIC FURNACES

DEVELOPMENTS. Developments in Electric Heat, G. H. Schaeffer. Iron & Steel Engr., vol. 4, no. 6, June 1927, pp. 276-281. Report covering field of electric heat for period that has elapsed since 1926 convention at Chicago; deals with electric melting; high-temperature and low-temperature furnaces roll heaters; hardening high-speed steel; heat treatment of rails; combined use of electricity with other fuel; bright annealing; electric hating of hot tops of steel ingots; high-frequency furnace developments.

REHEATING. Brown Boveri Reheating Furnaces, G. Keller. Brown Boveri Rev., vol. 14, no. 6, June 1927, pp. 143-154, 17 figs. Framework for all reheating furnaces of type Gth is made in Brown Boveri workshops, and comprises strong rolled sections; temperature regulation; switchgear; pyrometers; field of application; economy of electric heat.

ELECTRIC GENERATORS, A.C.

POLYPHASE. Theory of Polyphase Alternate Current Generator, W. C. Clinton. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. of Science, vol. 8, no. 6, June 1927, pp. 1334-1345. Extension of T. R. Lyle's work on simplest form of single-phase alternator to same form of multi-phase machines; general expressions for currents in any phase of such machine are deduced in terms of electrical constants of circuits, electromotive force in exciting circuit and frequency; conditions under which higher harmonics make their appearance in any of circuits and conditions to be fulfilled for their suppression.

SYNCHRONOUS. Additional Losses of Synchronous Machines, C. M. Laffoon and J. F. Calvert. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 6, June 1927, pp. 573-582 and (discussion) 623-626, 25 figs. In case of high-speed turbine generators, most reliable means of determining losses under actual operating conditions is to measure weight and temperature rise of cooling medium and to estimate small part of losses which is dissipated from frame to surrounding medium; temperature rise of cooling medium can be obtained by means of temperature detectors located at inlet and outlet sections of generator; volume of cooling medium passing through machine can be determined by introducing definite amount of heat energy into cooling medium and measuring its temperature rise, or measuring mean velocity head at outlet section of properly designed stock; loss tests were made on five 3,600 r.p.m. turbine generators when operated as synchronous condensers.

ELECTRICITY

OHM'S LAW. Ohm's Law, 1827-1927, H. J. Schapper. Elec. Engr. of Australia & New Zealand, vol. 4, no. 2, May 16, 1927, pp. 45-52. Review of Ohm's work; includes biographical sketch.

ELECTRIC LOCOMOTIVES

GREAT NORTHERN. Great Northern Electric Locomotives, E. R. Martin. Ry. Age, vol. 82, no. 30, June 25, 1927, pp. 1997-1998. Description of rotating apparatus and operating features.

ELECTRIC METERS

HIGH-TENSION BULK SUPPLIES. Metering High-Tension Bulk Supplies, G. F. Shotter. Elec. Times, vol. 71, no. 1858, June 2, 1927, pp. 757-759, 6 figs. Problem resolves itself into three parts: instrument transformers, use of special meters for two-way and for multiple feeder supplies and cost.

TYPES. Modern Electric Tariff Systems and Meters, F. Ferrari. A.E.G. Progress, vol. 3, no. 6, June 1927, pp. 157-171, 44 figs. Aim of modern tariff systems is to avoid, as far as possible, peaks and valleys in load curve, and it is from this point of view that tariff systems and meters are considered.

ELECTRIC MOTORS

REPAIRING. Correct Motor Repairs Keep Gear-Centre Distance Accurate, P. A. Pontius. Elec. Ry. Jl., vol. 69, no. 25, June 18, 1927, pp. 1080-1084. Ten surfaces on which wear will cause spreading of gear centres should be brought back to correct dimensions at each regular motor overhauling.

ELECTRIC RAILWAYS

CATENARY OVERHEAD. Catenary Overhead of the Virginian Railway, B. M. Pickens. Elec. Ry. Jl., vol. 70 no. 1, July 2, 1927, pp. 9-13, 4 figs. Catenary construction is used throughout for suspension of overhead contact line of Virginian Railway; system over each main-line track consists of mixed strand, copper and bronze messenger supporting through rigid bronze hangers either one or two hard-drawn grooved copper auxiliary wires and a single bronze contact wire.

ROLLING STOCK. Report of Committee on Electric Rolling Stock. Ry. Age, vol. 82, no. 28, June 11, 1927, pp. 1903-1908, 3 figs. Lateral forces acting upon locomotive when passing through curve; standard system of nomenclature for electric locomotives; Detroit, Toledo & Ironton, Virginian and Illinois central electrification; 20 years' electrical operation on New York, New Haven & Hartford. Report submitted to Am. Ry. Assn.

ELECTRIC TRANSMISSION LINES

LONG-DISTANCE. The Stabilization of Long-Distance Power-Transmission Systems. Mech. Eng., vol. 49, no. 7, July 1927, pp. 757-758. Particulars of new scheme that greatly enlarges the field of long-distance electric power transmission and opens for economic development new cources of power such as remote waterfalls or beds of cheap, low-grade fuels.

TOWERS. Model Transmission Towers Under Load, C. R. Young, W. B. Dunbar and H. J. A. Chambers. Can. Engr., vol. 52, no. 22, May 31, 1927, pp. 549-554, 9 figs. Centre of torsion of square windmill-type tower averages 0.0019 times width of tower from axis; special stress gauge devised; no axial stresses in ledger angles; observed stresses in cross-arm diagonals.

ELECTRIC WELDING, ARC

STEEL BUILDINGS. Arc-Welded Steel Building, G. D. Fish. West. Soc. Engrs.—Jl., vol. 32, no. 4, Apr.-May 1927, pp. 142-151 and (discussion) 151-160, 20 figs. It promises savings of about one-eighth of steel in buildings by designing for continuity of beams and girders, and prospect of erection without noise and vibration.

ELECTROPLATING

CHROMIUM. Advance in Chromium Plating, C. H. Proctor. Brass World, vol. 23, no. 6, June 1927, pp. 193-194. Advantages to manufacturers of plumbers' supplies, jewellery, glassware and others; commercial solutions unpatented; equipment necessary.

ELEVATORS

CONTROL. How a Variable-Voltage System Elevator Control Operates, C. A. Armstrong. Power, vol. 66, no. 2, July 12, 1927, pp. 46-50, 4 figs.

EMPLOYEES

SELECTION AND TRAINING. The Right Man for the Job, U. J. Lupien. Factory, vol. 38, no. 6, June 1927, pp. 1082-1084, 1208, 1210 and 1212, 3 figs. Selecting, training and re-educating workers.

EXPLOSIVES

SENSITIVENESS. Sensitiveness of Explosives and Sensitiveness Tests, A. La Motte. Cement, Mill & Quarry, vol. 39, no. 12, June 20, 1927, pp. 19-20. Deals with sensitiveness test as practised by field and laboratory forces of DuPont Co.

F

FACTORIES

BUILDING DESIGN. Which Shall That New Factory Be—Single- or Multi-Storey? M. Kahn. Factory, vol. 38, no. 6, June 1927, pp. 1096-1097, 6 figs. Practical points to be considered in making decision, as seeen by architects who have designed some of best-known plants in America, including those of Ford Motor Co.

BUILDINGS. Umbrella-Type Factory Building. Engineering, vol. 124, no. 3207, July 1927, p. 13, 7 figs. Steel roof work is of cantilever or umbrella type.

FLOOD CONTROL

FORESTRY AND. Do Forests Prevent Flods, R. Zon. Am. Forests, vol. 33, no. 403, July 1927, pp. 387-392. Points out that engineer and forester must work hand in hand if river system is to be converted from source of danger and expense to one of highest usefulness and revenue; this fact is so axiomatic that in Europe no system of river control would for a moment be contemplated that did not include protection of watershed by forests or other vegetation.

FLOTATION

SELECTIVE. Selective Flotation as Applied to Canadian Ores, C. S. Parsons. Can. Min. Jl., vol. 48, no. 23, June 10, 1927, pp. 468-474. Information acquired and progress made in treatment of ores by this method; points out assistance government is rendering mining industry by maintaining at Ottawa fully equipped ore-dressing and metallurgical laboratories for research on treatment of ores and metallurgical products.

FORESTRY

PULP AND PAPER INDUSTRY. Forestry in the Pulp and Paper Industry, D. A. Crocker. Paper Trade Jl., vol. 84, no. 24, June 16, 1927, pp. 34-40. Consumption vs. growth; what forestry can do; public and private measures; possibilities of utilization.

FOUNDATIONS

BUILDINGS. Foundations, G. R. Johnson. Engrs'. Soc. West. Pa.—Proc., vol. 43, no. 1, Feb. 1927, pp. 52-70 and (discussion) 70-79. Deals with spread footings, pile footings, open-method piers, pneumatic-method piers, combination open and pneumatic piers.

FATIGUE

INDUSTRIAL. Annual Report of the Committee on Elimination of Unnecessary Fatigue, G. H. Shepard. Soc. Indus. Engrs.—Bul., vol. 9, nos. 5-6, May-June 1927, pp. 27-29. Results of research.

FLOW OF FLUIDS

PIPES. Calculation of Fluid Friction in Pipes, A. J. Nicholas. Power, vol. 66, no. 2, July 12, 1927, p. 60, 1 fig. Wherever liquids flow in pipes this method is usable; liquid may be water, oil or any other fluid, liquid or gaseous; pipe may be full or partly filled and its surface may be smooth or rough.

FLOW OF GASES

PIPES. Discussion of Pipe Line Flow Formulæ, E. L. Rawlins. Natural Gas, vol. 8, no. 6, June 1927, pp. 8-11 and 15. Investigation of flow of natural gas through high-pressure natural gas transmission lines to secure accurate information that will help operators in designing their pipe lines and determining capacity effects under different operating conditions in order to secure more efficient operation.

FLUE-GAS ANALYSIS

CALCULATION. Flue Gas Analysis, C. C. Krausse. Am. Gas Jl., vol. 126, no. 25, June 18, 1927, pp. 599-603, 2 figs. Manipulation of apparatus and calculations.

CO_2 RECORDERS. CO_2 Recorders on Oil Burning Boilers, W. H. Stoetzel. Combustion, vol. 17, no. 1, July 1927, pp. 41-42, 1 fig. Demonstrates value of CO_2 recorders.

A Motor Driven CO_2 Recorder. Eng. & Boiler House Rev., vol. 4, no. 1, July 1927, pp. 27-30, 4 figs. Recorder which requires no water supply, extracting gear consisting of small electric motor and pump; this design has been put on market by Electroflo Meters Co.

FLUE GASES

CONTROL. Flue Gases and Their Direct Relation to Combustion Efficiency, A. Seton. Eng. & Boiler House Rev., vol. 40, no. 12, June 1927, pp. 610-613. Ideal flue gas consists of nitrogen, CO_2 and minimum quantity of oxygen: by suitable regulation of air supply, CO_2 content can be maintained at approximately 10 to 14 per cent: oxygen should not be more than 8 to 9 per cent and there should be no CO.

FLYWHEELS

CENTRIFUGAL STRESSES. Centrifugal Stresses in Flywheels. P. F. Foster. Machy. (Lond.), vol. 30, no. 765, June 9, 1927, pp. 301-304, 3 figs. Compares results obtained by cruder methods of calculation so largely employed as checks in design: only effects of centrifugal force are dealt with.

FOUNDRIES

DIRECT METAL PROCESS IN. Using Direct Metal in Foundry. Iron Age, vol. 119, no. 26, June 30, 1927, pp. 1869-1872. Blast-furnace iron and cupola iron mixed in Ford plant to obtain desired analysis; electric furnace controls temperature.

COSTING. Scientific Costing. J. W. Kearsey. Foundry Trade Jl., vol. 35, no. 565, June 16, 1927, p. 506. Determination of foundry costs can be handled much more satisfactorily by technical man than by an accountant, provided that he is conversant with fundamentals of costing and fully understands general basis on which he must work: principle of predetermination of costs must be definitely accepted: costs must be analyzed into factors and controlled by standards; orthodox methods unsuitable.

SMALL. What Is Wrong with the Small Foundry. P. Dwyer. Indus. Mgmt. (N.Y.) vol. 74 no. 1, July 1927, pp. 33-39. Small foundry occupies well-defined and necessary place in industrial field, but field is highly competitive: it is no longer rule-of-thumb, hit-or-miss proposition; it is highly intricate, highly involved and highly specialized business.

FOUNDRY EQUIPMENT

SAND MIXERS. Sand Mixer for Use in Continuous Handling Systems. Iron Age vol. 120, no. 2, July 14, 1927, p. 83. Capacity ranging from 60 to 85 tons of sand per hour is claimed for Simpson intensive sand mixer.

FUEL ECONOMY

ADVANCES IN. New Advances in Heat Economy. K. A. Hartung. Combustion, vol. 16, no. 6, June 1927, pp. 332-333. New methods and apparatus: tendency has been toward determination of oxygen content, procedure which gives constant results; type of meters and automatic regulation apparatus. Translated from paper read before Soc. German Chemists.

POSSIBILITIES. Possibilities of Fuel Economy. H. A. Brassert. Iron Age, vol. 120, no. 2, July 14, 1927, pp. 77-78. Suggests improvements in iron and steel industry: Germans lead in heat-saving refinements; gas enrichment proposed. Abstract of paper read before Eastern States Blast Furnace and Coke Oven Assn.

FURNACES, ANNEALING

CONTINUOUS. Continuous Furnace Used to Anneal Steel Castings. Iron Age, vol. 119, no. 26, June 30, 1927, p. 1897. Annealing period reduced as much as 2 hr. by rotary-type oven at Detroit plant.

G

GAUGES

PISTON PRESSURE. An Experimental Study of the Piston Pressure Gauge to Six Hundred Atmospheres. F. G. Keyes and J. Dewey. Optical Soc. of Am.—Jl., vol. 14, no. 6, June 1927, pp. 491-504, 1 fig. Method of extending comparisons of piston-type pressure gauge with mercury column used by Holborn and Schulze has been modified.

How to Make a Mercury Absolute Pressure Gauge. Power, vol. 66, no. 1, July 5, 1927, pp. 17-18, 2 figs. Absolute pressure may be read directly; only one instrument required: temperature and other corrections eliminated.

GAS ENGINES

PERMANENT-GAS. Is the Permanent-Gas Engine a Possibility? J. Sturgess. Power vol. 65, no. 26, June 28, 1927, pp. 990-992. Old-time hot-air engine failed because of its low temperature range; by increasing maximum temperatures to 1,100 deg. net efficiency of 24 per cent is claimed; pressures are low when compared to other modern machines of equal efficiency.

GAS WORKS

WASTE-HEAT UTILIZATION. Surplus Heat Utilization in Canadian Coal Gas Plants W. C. Philpott. Gas Age-Rec., vol. 59, no. 26, June 25, 1927, pp. 925-926. Reviews subject of heat losses occurring in coal carbonization, and describes what is being accomplished in heat recovery.

GASOLINE

AIR DETERMINATION IN. Apparatus to Determine Air in Gas, F. P. Peterson. Oil & Gas Jl., vol. 26, no. 5, June 23, 1927, p. 162. Skill necessary in making tests if accurate results are required; explains usual sources of error.

GEARS

PINION CUTTING. Pinions Cut from Enlarged Blanks. Machy. (Lond.), vol. 30, no. 765, June 9, 1927, pp. 289-292, 5 figs. Increased strength of enlarged pinions and data for establishing blank sizes; question of tooth interference: increase in centre distance and pressure angle; effect on base circle radius: cutting over-size gears.

STEEL FOR. Recommended Practice for Forged and Rolled Carbon Steel for Gears. Can. Machy., vol. 37, no. 24, June 16, 1927, p. 30. As submitted by Metallurgical Committee of Am. Gear Mfrs'. Assn.

STEEL RING AND CAST-IRON CENTRE. Builds Gears with Steel Ring and Cast-Iron Centre. Iron Trade Rev., vol. 81, no. 1, July 7, 1927, p. 13, 2 figs. Gear design, which has forged steel teeth and a semi-steel hub, has been developed by Hill Clutch Machine & Foundry Co., Cleveland; construction is simply annular forged ring in which is cast hub either with web or arms, depending on dimensions; after casting, completed gear is finish machined and teeth cut.

WORM. Some Common Misconceptions in Worm Gear Design. H. L. Blood and D. V. Waters. Am. Mach., vol. 66, no. 25, June 23, 1927, pp. 1041-1042, 8 figs. Better design is sometimes obtained if addenda of worm and gear are unequal; increase of pressure angle used to avoid under cutting; simplified gear-blank form.

WORM-WHEEL CONTACT. Worm-Wheel Contact, E. Buckingham. Mech. Eng. vol. 49, no. 7, July 1927, pp. 785-792 and (discussion) 792-793, 20 figs. Preliminary report of A.S.M.E. special research committee on worm gears; shows how any worm-wheel contact condition can be determined by analysis and points out in particular probable influence of nature of contact lines between a worm and a worm wheel upon lubrication conditions, efficiency and load-carrying ability; analyses of three helicoids and their equations; contact lines of screw helicoids used as worms and those of involute helicoids used as worms; contact lines of screw helicoids with large helix angles, and involute helicoids with large helix angles.

GLUE

METAL POLISHING. Glue—Its Importance in Metal Polishing. W. S. Barrows. Can. Foundryman, vol. 18, no. 5, May 1927, pp. 17-19. Not only has best glue been specified, but particular kind of best glue has been found necessary, namely—" skin glue " or " hide glue " made from skins or hides of animals.

GRAIN ELEVATORS

SOUTH AMERICA. Grain Elevators (Elevadores de granos). F. y Gutierrez. Ingenieria, vol. 31, no. 3, Mar. 1927, pp. 159-162. Preliminary project for construction of terminal elevator at port of Diamante, 24,000 tons in capacity, and of two elevators in country of 1,350 tons and 2,650 tons capacity.

GRINDING

JOBBING SHOP. Unusual Grinding Problem in a Jobbing Shop. H. R. Simonds. Abrasive Industry, vol. 8, no. 7, July 1927, pp. 216-218, 4 figs. Methods and equipment at plant of Tait-Pierce Mfg. Co. Woonsocket, R.I.: grinding connecting-rod forks.

GRINDING MACHINES

DRY. Electrically Driven Double Dry-Grinding Machines. Engineer, vol. 143, no. 3727, June 17, 1927, p. 667, 4 figs. Built by B. R. Rowland & Co. for New Zealand railway: particularly intended for fettling purposes in foundries, steel forgings or for constructional work.

LEAF-SPRING. Badger Leaf-Spring Grinder. Am. Mach., vol. 66, no. 26, June 30, 1927, p. 1113, 2 figs. For automatically grinding eyes of leaf springs and bumpers.

SHEET-EDGE. A New Sheet-Edge Grinding Machine. Engineer, vol. 143, no. 3728, June 24, 1927, p. 692, 1 fig. Soag G. I. sheet grinder built with object of rapidly grinding and slightly beveling both edges.

UNIVERSAL. Landis Self-Contained Universal Grinding Machines. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 869-870, 2 figs. Each machine is equipped with three motors, one of which drives work-head, another wheel-head, and third, carriage power-traverse and water pump.

H

HAMMERS

PNEUMATIC. " Clear Space " Pneumatic Power Hammer. Engineer, vol. 143, no. 3727 June 17, 1927, p. 666, 2 figs. New range of hammers introduced by B. & S. Massey, Manchester, Eng., which provide adequate clear space above and around anvil block for easy manipulation of bulky tools and jobs.

HARDNESS

TESTING. Determination of the Fatigue Hardness of Metals. Eng. Progress, vol. 8, no. 5, May 1927, pp. 131-132, 4 figs. Oscillatory testing machine manufactured by firm of Carl Schenck in Darmstadt permits of testing bar-shaped test pieces under tension and compression alternating at 500 oscillations per sec.

HEAT TREATMENT

PRACTICE. Metals and Their Heat Treatment. S. G. Williams. Roy. Aeronautical Soc.—Jl., vol. 21, no. 198, June 1927, pp. 602-613. Deals with heat treatment of alloy steels and light alloys: points out that all functions of hardening and tempering can be better carried out if ideal temperatures are worked to; quenching oil is often not cold enough towards end of day.

HEATING, STEAM

DISTRICT. Steam Distribution Service in New York City. Eng. & Boiler House Rev., vol. 40, no. 12, June 1927, pp. 607-610, 5 figs. Details of equipment for supplying steam over wide area of New York City.

The Use of Power Stations for the Heating of Buildings in Near-by Sections (Het gebruik van electriciteitsfabrieken voor verwarming van gebouwen in nabij gelegen stadsgedeelten). J. J. F. Smits. Ingenieur, vol. 42, no. 3 Jan. 15, 1927, pp. 37-45, 11 figs. Practice of central heating and hot-water supply in Dutch cities, particularly Utrecht, also cost data.

HOSPITALS. The Heating Installation of University College Hospital, London. Engineering, vol. 124, no. 3207, July 1, 1927, pp. 1-4, 20 figs. Steam required for heating amounts to 750 lb. a day during winter period: whole quantity is supplied by 5 Lancashire boilers.

STORES. Engineering Work in a Provincial Stores. Engineer, vol. 144 no. 3070, July 8, 1927, p. 47, 6 figs. Heating installation is operated on vacuum steam system; high-pressure steam is used for hot-water supplies.

HIGHWAYS

BITUMINOUS-SAND SURFACES. Alberta Bituminous Sand for Highways, S. C. Ells. Can. Engr., vol. 52 no. 21, May 24, 1927, pp. 531-537, 8 figs. Bituminous-sand deposits at Fort McMurray, Alberta, being used for surfacing roads in province: description of two types of mixing plant for manipulating sands: road at Jasper treated successfully with this material.

RESEARCH. New Developments in Highway Research, S. S. Steinburg. Can. Engr., vol. 52, no. 23, June 7, 1927, pp. 571-572. Problems which have developed in highway construction due to increase in motor traffic.

HOBBING MACHINES

SINGLE-PURPOSE. No. 34 Gear Hobbing Machine (Single-Purpose). Iron & Steel of Can., vol. 10, no. 5, May 1927, p. 153. Furnished with change, gears and bracket to hob only one specified size of gear: it is designed efficiently to handle quantity production of spur gears of from 8 to 35 teeth, and is equipped for hobbing only one particular size in this range.

HOISTS

BLOCKS. A New Type of Electric Hoisting Block. Eng. Progress, vol. 8, no. 6, June 1927, pp. 145-146, 4 figs. Describes block put on market by firm of Bamag-Dessau with only two sets of gears.

HYDRAULIC GEARS

VARIABLE-SPEED. An Improved Variable-Speed Gear. Colliery Eng., vol. 4 no. 40, June 1927, pp. 237-238 and 252, 5 figs. Improved design of hydraulic variable-speed gear for use in collieries.

HYDRAULIC TURBINES

GOVERNORS. Problems in the Use of Water Wheel Governors. Power Plant Eng., vol. 31, no. 14, July 15, 1927, pp. 795-796. Discusses possibility of omitting governors entirely, together with data on various governor details and operating problems.

PELTON. Large Verticle-Shaft Pelton Wheels (Turbines Pelton à axe vertica de Maipo). Bul. Technique de la Suisse Romande, vol. 25, no. 24, Nov. 20, 1926, pp. 291-292, 1 fig. Ordinary type of Pelton wheel, with horizontal shaft, does not lend itself to use of more than two jets, hence multiple wheels have frequently to be employed; with vertical shafts, however, four jets can be used, and space occupied by machine is materially reduced; leading particulars are given concerning three Escher-Wyss machines of this type for Maipo (Chile) plant: spear rods pass through supply pipe, and latter, in form of spiral, serves as support for alternator. See also Génie Civil, vol. 90, no. 11, Mar. 12, 1927 p. 275, and brief translated abstract in Power Engr., vol. 22 no. 255, June 1927 p. 233.

HYDRO-ELECTRIC DEVELOPMENTS

Middle West. Middle Western Water Power Developments, F. A. Nagler. Power Plant Eng., vol. 31, no. 12. June 15, 1927, pp. 688-689. Development of small hydro-electric plants in Middle West depends largely upon their ability to carry peak loads on larger system. Abstract of paper presented before Iowa Power Conference.

Victoria. Sugarloaf-Rubicon Hydro-Electric Development, Victoria. Commonwealth Engr., vol. 14, no. 9, Apr. 1, 1927, pp. 351-355, 11 figs. Energy from this development will be used to supply high load-factor portion of metropolitan demand, and to provide for demand in north-eastern district; scheme involves laying down of number of hydro-electric stations at Sugarloaf reservoir on Goulburn river and one some of swift-flowing tributaries of that river.

HYDRO-ELECTRIC PLANTS

Conowingo, Md. Unusual Engineering Features of the Conowingo Dam and Power Plant, N. E. Funk. Franklin Inst.—Jl., vol. 203. no. 6, June 1927, pp. 745-780, 36 figs. Construction of dam and power house with initial wheel capacity of 378,000 h.p.; lake will be formed at elevation of 108.5 ft. above sea level, extending 14 miles upstream; present Conowingo bridge over Susquehanna river will be flooded, and it is therefore necessary to provide some adequate structure to replace submerged bridge.

Ontario. Fort William Now Using Hydro Power, R. B. Perring. Power House, vol. 21, no. 11, June 5, 1927, pp. 33-36, 5 figs. Station of 15,000-kva. capacity to transform voltage from 110 to 22 kv. in addition to transformer substation erected when Fort William becomes link in Ontario Hydro-Electric Power Commission's system.

I

ICE PLANTS

Diesel Engine Drives. Diesel Engine Drive for Ice Plants, R. L. Howes. Ice & Refrigeration, vol. 72, no. 6, June 1927, pp. 573-576, 3 figs. Paper read before Nat. Assn. Practical Refrig. Engrs. Reliability of Diesel engines; repair and maintenance expense.

Raw Water. A Modern Raw Water Ice Making Plant at Richmond, Virginia, T. Mitchell. Ice & Refrigeration. vol. 73, no. 1, July 1927, pp. 17-19, 5 figs. New plant of Electric Ice Manufacturing Co., Richmond, Va.; cash-and-carry system a feature; labour reduced to minimum; particulars of refrigerating equipment.

INDUSTRIAL PLANTS

Equipment Location. Reducing Unit Labour Cost 20 Per Cent, J. A. Piacitelle. Mfg. Industries, vol. 14, no. 1, July 1927, pp. 31-32, 6 figs. Studies of machines and other work places show how to arrange equipment to lower fatigue and increase production.

Location. An Analysis of Factors Affecting Plant Location, J. J. Berliner. Indus. Mgmt. (N.Y.), vol. 74, no. 1, July 1927, pp. 39-41. Economic factors governing selection of industrial site; part played by raw materials in factory location; skilled and unskilled labour; question of power; nearness to market.

Maintenance. Keeping the Factory in Running Order, A. B. Vieth. Indus. Mgmt. (N.Y.), vol. 74, no. 1, July 1927, pp. 11-14. Practical aspects of general plant maintenance.

Noises. The Tremendous Toll of Industrial Noise, C. F. Faulkner. Factory, vol. 38, no. 6, June 1927, pp. 1079-1081, 1172, 1174, 1176 and 1178. 9 figs.

INDUSTRIAL TRUCKS

Lift. Cutting Storage and Shipping Costs, F. L. Eidmann. Indus. Mgmt. (N.Y.). vol. 74, no. 1, July 1927. pp. 28-32, 13 figs. Adaptability of lift truck and skid system.

INSULATORS, ELECTRIC

Testing. Testing Live Pin-Type Insulators, W. B. Buchanan. Elec. News, vol. 36, no. 11, June 1, 1927, pp. 35-36, 2 figs. Statiphone is new device used by Ontario hydro in field; detects faults not visual.

INTERNAL-COMBUSTION ENGINES

Exhaust-Gas Utilization. The Recovery and Utilization of Heat from the Exhaust Gases of Internal-Combustion Marine Engines, T. Clarkson. Inst. Mar. Engrs.—Trans., vol. 39, June 1927, pp. 215-229 and (discussion) 229-253. Analyzes conditions which are most favorable to heat recovery; boilers used for waste-heat recovery; utilization of recovered heat.

Valves. Combined Cuff and Mushroom Valve for Internal-Combustion Engines. Engineering, vol. 123, no. 3205, June 17, 1927, p. 751, 1 fig. Designed by M. Schulp; it embodies ordinary overhead mushroom valve surrounded by cuff valve; two annular spaces surrounding latter constitute ports, upper being inlet and lower exhaust port.

See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines.

IRON AND STEEL

Analysis. Determination of Silicum, Phosphorus, Sulphur and Manganese (Dosages du Silicium, du Phosphore, du Soufre et du Manganese), M. Marqueyrol and L. Toquet. Revue Générale des Chemins de Fer, vol. 46, no. 6, June 1927, pp. 552-560. Use of mixture of potassium chlorate and nitric acid has made it possible to establish accurate method of analysis for iron, cast iron and steel.

Corrosion. Report of Committee A-5 on Corrosion of Iron and Steel. Am. Soc. Testing Matls.—Advance Paper, no. 12, for mtg. June 20-24, 1927, 72 pp., 22 figs., partly on supp. plate. Report on inspection of Fort Sheridan and Annapolis tests; specifications for zinc-coated products; zinc-coated sheets; testing zinc-coated iron and steel(galvanized) wire and wire products, iron or steel telephone and telegraph line wires, iron or steel tie wires, wire fencing, chalk-line fence fabric galvanized before weaving and after weaving; methods of testing; field tests of metallic coatings.

Zinc Coatings. Report of Sectional Committee on Specifications for Zinc Coating of Iron and Steel. Am. Soc. Testing Matls.—Advance Paper, no. 28, for mtg. June 20-24, 1927, 3 pp. Committee reports on plates, bats, structural shapes and their products; pipes, conduits and their fittings.

IRON CASTINGS

Gas Holes. Absorbed Gases in Iron and the Creation of Gas Holes in Castings. B. Hird. Foundry Trade Jl., vol. 35, no. 565, June 16, 1927, pp. 495-497, 3 figs. As result of experiments and past experience following conclusions are arrived at: sprigs, chaplets, studs, etc., are always source of danger; their contact with molten metal in mould should be avoided wherever possible; when chills or metal inserts of any kind are used in moulds in contact with molten metal, vent holes should be put in them to allow gases to escape; where chills are brought up to high temperature in mould, they should be renewed at frequent intervals; moulds having inserts should be poured with metal as dull as is consistent with type of casting; amount of gas given off by chills, etc., is largely influenced by temperature to which they are raised by molten metal in mould, before solidification takes place; all cast metals give off gases when liquid and during solidification until they reach point well below dull red.

Large. The Manufacture of Large Castings (La fabrication des grosses pièces en fonte). H. Fabre. Fonderie Moderne, vol. 21, May 25, 1927, pp. 125-131, 4 figs. Deals with castings of large dimensions which present difficulties in moulding; material employed patternmaking, moulding, defects, etc.

INSPECTION

Navy Material. Inspection of Naval Material, H. C. Dinger. Am. Mach., vol. 67. no. 2, July 14, 1927. pp. 59-60. Methods used in inspecting material at source of supply; advantages to be secured by consolidation of inspection offices are many and great.

K

KEYS

Design. Keys and Keyways, H. Bentley. Mech. World, vol. 81, no. 2106, May 13. 1927, pp. 335-337, 29 figs. Types of keys and their application.

KILNS

Downdraft Periodic, Firing. Notes on Firing in Downdraft Periodic Kilns, R. Linton. Am. Ceramic Soc.—Jl., vol. 10, no. 7, July 1927, pp. 493-500, 15 figs. Results of series of investigations chiefly in connection with firing, with general discussion of factors entering into heat treatment of silicate materials.

L

LABORATORIES

Foundry. Laboratories and Works of Beecroft & Partners, Limited. Foundry Trade Jl., vol. 35, no. 565, June 16, 1927, pp. 503-504, 2 figs. Laboratories comprise balance and combustion room, which is equipped with gas-fired, 4-tube carbon combustion furnace fitted with Huxley type of special muffle; reference is made to carbon train of this furnace as into this important modifications have been introduced by laboratory staff.

LATHES

Camshaft Turning Machine. Integral Camshaft Turning Machine. Machy. (Lond.), vol. 30, no. 767, June 23, 1927, pp. 357-359, 5 figs. Machine is production of firm of Harry F. Atkins; one operator can work two of these machines, output of each being from 8 to 10 camshafts per hour, either from solid or from forging.

Centre. 8½-Inch Centre Tool Room Lathe. Machy. (Lond.), vol. 30, no. 767, June 23, 1927, pp. 376-377, 2 figs. Dean, Smith & Grace, Ltd., Keighley, have introduced lathe with V-bed.

Screw-Cutting. 18-Inch Sliding, Surfacing and Screw-Cutting Lathe. Engineering, vol. 123, no. 3205, June 17, 1927, pp. 748-749, 3 figs. Constructed by Tangyes, Ltd., Birmingham, England; work up to length of 23¼ ft. can be carried between centres and gap is provided for face-plate work.

LIGNITE

Briquetting. The Briquette Works at Yallourn, Victoria, Australia, F. W. Foos. Eng. Progress, vol. 8, no. 5, May 1927, pp. 113-117, 8 figs. Site and extent of lignite deposits at Yallourn; mining lignite; large electric power station; description of briquette work; steam and electrically driven briquette presses.

LOCOMOTIVE BOILERS

Corrosion and Pitting. Corrosion and Pitting in Locomotive Boilers, C. A. Seley. Ry. Club of Pittsburgh—Official Proc., vol. 26, no. 6, Apr. 28, 1927, pp. 121-154. Review of recommendations contained in prize paper by W. M. Barr, with brief résumé of reasons therefor and views of other writers.

Research. Improving the Locomotive Boiler by Research, L. H. Fry. Ry. Age, vol. 82, no. 28, June 11, 1927, pp. 1878-1883, 3 figs. Efficiency of combustion and efficiency of heat absorption; absorption of heat by radiation; transfer of heat by gas convection.

LOCOMOTIVES

Design. Capacity and Economy Gained in Latest Locomotive Design, H. S. Vincent. Central Ry. Club of Buffalo—Official Proc., vol. 35, no. 3, May 1927, pp. 2354-2381, 28 figs. Practical operations have demonstrated its efficiency for greater power, speed and longer trains; locomotive of future will very likely use high steam pressure, probably from 400 to 600 lb., and be provided with water-tube firebox.

Locomotive Parts and Their Assembly (Mise en euvre des éléments des locomotives), L. Wiener. Assn. des Ingénieurs Sortis des Ecoles Speciales de Gand—Annales, no. 17, 1927, pp. 239-305. Notes on engine parts, fuel, standardization, number of locomotives for one system; standardization of locomotives and their parts; locomotive capacities; establishment of specifications; damping.

Modern Locomotive Design. Pac. Ry. Club—Jl., vol. 11, no. 2, May 1927, 35 pp., 16 figs. Its significant influence on railroad operation.

Design and Construction. Report on Locomotive Design and Construction. Ry. Age, vol. 82, no. 28, June 11, 1927, pp. 1883-1895, 12 figs. Standardization of fundamental parts of locomotives; rail stresses under locomotives; provisions for expansion of locomotive boilers on frames; boiler pressures higher than 200 lb.; oil-electric locomotives. Paper read before Am. Ry. Assn.

Diesel-Electric. The Development of the Diesel-Electric Locomotive. Engineering, vol. 123, nos. 3201 and 3206, May 20 and June 24, 1927, pp. 608-610 and 760-763, 21 figs., 6 figs. partly on supp. plate. Details of 300-h.p., 6-cylinder crude-oil engine for railway traction developed by Wm. Beardmore & Co.

The Diesel-Electric Locomotive, F. K. Fieldes. Ry. Age, vol. 82, no. 29, June 18, 1927, pp. 1939-1942, 6 figs. Pennsylvania-Bessemer four-wheel Diesel locomotives; locomotive is designed for single-end control; engines have normal speed of 800 r.p.m.; cooling system designed for variety of conditions. Abstract of paper read before section meeting of Am. Soc. Mech. Engrs. at Altoona.

Diesel Locomotives, L. G. Coleman. Ry. Club of Pittsburgh—Official Proc., vol. 26, no. 7, May 26, 1927, pp. 159-182, 3 figs. If satisfactory internal-combustion locomotive using oil for fuel can be developed for all classes of service, overall thermal efficiency can be increased from present 5 or 6 per cent of steam to 25 per cent; internal-combustion locomotive shows immediate saving in fuel burned, roughly in proportion to its thermal efficiency; oil-electric locomotives require much less roundhouse and shop capacity.

Diesel-Engined. Diesel-Engined Locomotives and Railway Motor Cars (Automotrices actionnées par moteurs à huile lourdes Diesel et analogues), M. Mellini. Industrie des Voies Ferrées et des Transports Automobiles, vol. 21, no. 244, Apr. 1927, pp. 207-214, 4 figs. Deals with possibilities of Diesel engine as substitute for steam traction and electric traction; Diesel-electric locomotives and rail cars; Diesel-hydraulic and Diesel-pneumatic locomotives.

Draughting. The Next Step in the Development of Locomotive Draughting, W. F. M. Goss. Ry Age, vol. 82, no. 28, June 11, 1927, pp. 1900-1903, 3 figs. Comprehensive review of development of draught and draught appliances used in modern steam locomotive; forecasts probable future development of turbo-exhauster shown by service tests to have many important advantages. Paper read before Am. Ry. Assn.

FORCED DRAUGHT. Forced Draught Through Closed Ash Pans in Locomotives. Ry. Age, vol. 83, no. 2, July 9, 1927, pp. 63-64, 3 figs. Among most interesting developments in connection with locomotive operation is that of forced or controlled draught, as applied to a 2-10-2 locomotive on Texas & Pacific.

INTERNAL-COMBUSTION. Internal-Combustion Motive Power, A. I. Lipetz. Ry. Mech. Engr., vol. 101, no. 7, July 1927, pp. 433-441, 6 figs. Abstracts of Am. Ry. Assn., Mechanical Division committee reports on automotive rolling stock, and paper on oil-engine locomotives, by A. I. Lipetz.

OIL-ENGINED. The Status of the Oil-Engine Locomotive, A. I. Lipetz. Ry. Age, vol. 82, no. 28, June 11, 1927, pp. 1869-1875. Oil engines for transmission locomotives; power transmission; locomotives with direct drive. Paper read before Am. Ry. Assn.

PROGRESS. Progress of the Steam Locomotive. Ry. Mech. Engr., vol. 101, no. 7, July 1927, pp. 405-423, 12 figs. Review of three papers presented before Am. Ry. Assn., as follows: Locomotive Development and Cost of Operations, W. H. Winterrowd; Improving the Locomotive Boiler by Research, L. H. Fry; Developments in Locomotive Draughting, W. F. M. Goss.

UTILIZATION. Report on Locomotive Utilization. Ry. Age, vol. 82, no. 28, June 11, 1927, pp. 1908-1912. Statistics for supervising utilization of locomotives; dispatching of locomotives and trains; locomotive repairs. Report to Am. Ry. Assn.

VALVE GEARS. Motion Work on the L.V.R.R., S. A. Hand. Am. Mach., vol. 66, no. 25, June 23, 1927, pp. 1037-1040, 10 figs. Equipment employed for removal and replacement of eccentric cranks of Walschaert and Baker valve gears.

LUBRICANTS

INFECTION FROM. Infection from Lubricants, F. L. MacNamara. Safety Eng., vol. 53, no. 6, June 1927, pp. 243-248. Results of Houghton investigation; infection is bacterial; bacteria, or germ, is not present in oil; germ has no power to create boil or sore until it has secured ingress to skin; all cutting oils have skin-penetrating powers.

SPECIFICATION WRITING. Specification Writing for Petroleum Lubricants, M. R. Schmidt. Soc. Automotive Engrs.—Jl., vol. 20, no. 6, June 1927, pp. 750-753. Numerous examples are given to show that many specification writers are lamentably ignorant of characteristics that are and are not relevant, of nature of materials and of limitations of analysis and test methods.

WAX. Wax Lubricants, D. W. Mathison. Bell Laboratories Rec., vol. 4, no. 5, July 1927, pp. 390-391. Use of wax lubrication.

LUBRICATING OILS

CARDON DEPOSITING TENDENCY. Carbon and Lubricating Oils. Soc. Automotive Engrs.—Jl., vol. 20, no. 6, June 1927, pp. 688-690, 1 fig. Carbon-depositing tendency of heavier motor oils; Conradson carbon-residue test; from these considerations it appears desirable to use an oil viscous enough to supply necessary lubrication, but volatile enough to vaporize after it has reached piston and cylinder-head surfaces, leaving minimum of residue.

LUBRICATION

FACTORY EQUIPMENT. Lubrication: The Vital Point of Maintenance, K. D. Hamilton. Factory, vol. 38, no. 6, June 1927, pp. 1093-1095, 5 figs. Surest provision for unfailing lubrication is definite schedule for each lubricating operation and rigid observation of that schedule; problems of steam-engine and steam-turbine lubrication.

HIGH-TEMPERATURE. High-Temperature Lubrication. Lubrication, vol. 13, no. 5, May 1927, pp. 49-54, 7 figs. Factors which must be considered when selecting lubricants for such service.

OIL COOLERS. Oil Cooler Cleaning Made Easy, W. H. Burton. Power, vol. 66, no. 2, July 12, 1927, pp. 45, 1 fig. Simple apparatus facilitates removal of oil sludge from oil-cooler tube bundles; its installation is justified when considerable number of coolers must be cleaned during year.

M

MACHINE TOOLS

BELTLESS. New Beltless Machine Tools, A. Bahls. Eng. Progress, vol. 8, no. 6, June 1927, pp. 165-166, 3 figs. In beltless drives, electric motor is usually either direct-coupled with shaft of driven machine or tool holder of machine is mounted right on shaft of motor; in latter case, motor has to be of special design and either possess double bearings or bearings reinforced in some other way; such machines are built for milling bodies of tooth brushes and combs, and others are designed solely for making sawn celluloid combs.

DRIVES AND CONTROLS. Recent Developments in Machine Tool Drives and Controls. Machy. (Lond.), vol. 30, no. 766, June 16, 1927, pp. 321-344, 58 figs. Electrical and hydraulic applications; their influence on machine design and output; characteristics and suitability of electric motors and controls; self-contained motor drive; flange motors; vertical motors; traversing and feeding motors; hydraulic drive and feed.

SERVICING. Servicing Machine Tools. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 823-824. Outlines need for definite policy in machine-tool industry.

T-SLOTS. Standard T-Slots for Machine Tools. Am. Mach., vol. 66, no. 26, vol. 67, no. 1, June 30 and July 7, 1927, pp. 1101 and 31, 8 figs. Reference-book sheet.

WELDED BASE. Circular Welded-Steel Machine Base, R. E. Kinkead. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 850-851, 3 figs. Three fundamental rules used by Engineering Department of Lincoln Electric Co.

MANGANESE STEEL

PROPERTIES. Fact and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 12, no. 1, July 1927, pp. 106-125, 5 figs. Effects of manganese in simple steels and composition, properties and uses of various types of manganese alloy steels; new charts showing physical properties of some of pearlitic manganese steels are presented; properties of high-manganese steels; effects of manganese in steel castings and properties of steels containing manganese in combination with other alloying elements.

MASONRY

STRENGTH. Masonry Strength at Early Stages, J. S. Elwell. Concrete Products, vol. 32, no. 6, June 1927, p. 38. Results of tests recently completed at the Rock Island Arsenal on the strength of wall specimens laid up in lime mortar. Paper presented before the Building Officials' Conference.

MECHANISMS

MODERN. Ingenious Mechanical Movements. Machy. (N.Y.), vol. 33, no. 11, July 1927, pp. 811-813, 2 figs. Contains following descriptions: Overload Release with Positive Lock, G. Sandberg; Variable and Reversing Rotation for Feed-Rolls, S. H. Helland; Triple Intermittent Worm-Gear, F. C. Mason; New Tube Operates on One-Billionth of an Ampere.

METALS

TEMPERATURE, EFFECT OF. Joint Research Committee no Effect of Temperature on the Properties of Metals. Am. Soc. Testing Matls.—Advance Paper, no. 24, for mtg. June 20-24, 1927, 4 pp. Progress report to sponsor societies; future programme.

WEAR TESTING. Wear Testing of Metals, H. J. French. Am. Soc. Testing Matls.—Advance Paper, no. 41, for mtg. June 20-24, 1927, 19 pp., 11 figs. Factors affecting wear of metals and difficulties encountered in making both laboratory and service wear tests; two testing machines used in study of wearing properties of metals employed for widely different purposes are described and attention is given in particular to initial surface condition and "filming" of metals in relation to procedure employed in making wear tests; summary of present status of wear testing of metals and results of experimental work to show that reproducible results and information consistent with practical experience can be secured in laboratory.

MINES

SAMPLING. Methods of Mine Sampling, G. N. Bjorge. Min. Congress Jl., vol. 13, no. 6, June 1927, pp. 474-475. Summary of data received from 55 mining companies, including most of important companies of North America, on present practice; suggestions as to how such practice may be standardized.

MILLING MACHINES

MULTIPLE-SPINDLE. Automatic Multiple-Spindle Equipment for Sewing Machines. Am. Mach., vol. 67, no. 2, July 14, 1927, pp. 56-57, 6 figs. Special multiple-spindle milling and drilling machines designed for use in manufacture of sewing machines.

MOULDING METHODS

CONTINUOUS. Continuous Moulding Operations with Minimum of Manual Work. Iron Age, vol. 119, no. 25, June 23, 1927, pp. 1817-1818. Methods and equipment of Maytag Co., Newton, Iowa.

LOAM. A Centralizing Disc in Loam, B. Shaw and J. Edgar. Foundry Trade Jl., vol. 35, no. 564, June 9, 1927, pp. 485-487, 13 figs. Loam is particularly useful in making of moulds for large castings which are circular in shape, especially when but few similar castings are required; centralizing disk is good illustration of type of work for which loam is well suited as medium for taking necessary shape.

MOTOR TRUCKS

BRAKES. Internal Wheel-Brakes for High-Speed Heavy Vehicles, H. D. Church. Soc. Automotive Engrs.—Jl., vol. 20, no. 6, June 1927, pp. 717-721, 5 figs. Deals primarily with internal wheel brakes for trucks and motor coaches, but passenger car brakes with similar characteristics are considered possible; simple two-shoe internal-expanding type developed mainly by empirical methods is found to be most practical solution.

DUAL-PURPOSE SIX-WHEELERS. Dual-Purpose Six-Wheelers, M. Terry. Motor Transport, vol. 44, no. 1, 161, June 13, 1927, pp. 695-697, 3 figs. Suggestions on design to render six-wheeled chassis equally suitable for road and road-less work.

N

NICKEL

CANADA. Nickel in Canada. Metal Industry (Lond.), vol. 30, no. 24, June 17, 1927, pp. 605-608. Sources; ores, operating companies, mining methods; smelting and refining; Monel metal, nickel steel; summary of the use of various commercial forms of nickel.

NICKEL ALLOYS

MELTING. Melting Nickel Alloys, J. A. Duncan. Metal Industry (N.Y.), vol. 25, no. 7, July 1927, p. 280, 2 figs. Pouring of high-temperature metal castings improved by gas.

NON-FERROUS METALS

SPECIFICATIONS. Report of Committee B-2 on Non-Ferrous Metals and Alloys. Am. Soc. Testing Matls.—Advance Paper, no. 18, for mtg. June 20-24, 1927, 44 pp., 5 figs. Proposed revisions of standards and tentative standards; methods of analysis of light aluminum alloys; tentative specifications for copper tubing for refrigerators; brazing solder; yellow brass sand castings for general purposes; bronze castings in rough for locomotive wearing parts; car and tender journal bearings lined; rolled zinc.

CORROSION. Report of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys. Am. Soc. Testing Matls.—Advance Paper, no. 19, for mtg. June 20-24, 1927, 18 pp. Total-immersion tests; spray corrosion test; accelerated-electrolytic test; atmospheric corrosion; liquid corrosion; galvanic and electrolytic action.

NOZZLES

DISCHARGE COEFFICIENTS. A Note of the Coefficients of Discharge of Nozzles, S. J. Davies. Engineering, vol. 124, no. 3207, July 1, 1927, pp. 5-7, 5 figs. Tests carried out in order to compare orifice of tube calibrated by Watson and Schofield with German standard nozzle as calibrated in 1923 by Jakob and Erk; results of inquiry throw doubt on constancy of coefficient of German standard nozzle.

O

OIL ENGINES

AUXILIARY GENERATING STATIONS. The Oil Engine Reinforces the Central Station, S. A. Hadley. Oil Engine Power, vol. 5, no. 7, July 1, 1927, pp. 462-464. Using oil-engine power to extend overloaded transmission systems.

FUEL-INJECTION SPRAY. Oil Sprays in Fuel Injection Engines, E. S. Beardsley. Power Plant Eng., vol. 31, no. 12, June 15, 1927, pp. 678-680, 9 figs. High-speed motion pictures show formation and characteristics of jets and effects of conditions.

FUEL-PUMP MAINTENANCE. Maintaining Fuel Pumps and Spray Valves, A. B. Newell. Oil Engine Power, vol. 5, no. 6, June 1927, pp. 402-405. Practical inspection and adjustment procedure.

FUEL SPRAY. Penn State Oil Spray Research, P. H. Schweitzer. Oil Engine Power, vol. 5, no. 6, June 1927, pp. 388-390, 2 figs. Experimental equipment at Pennsylvania State College.

GENERATOR SETS. A 165 K.W. Oil Engine Driven Generator Set. Engineer, vol. 144, no. 3729, July 1, 1927, p. 19, 2 figs. Engine is four-cycle airless-injection type having 5 cylinders.

INDICATORS. Oil-Engine Research at Pennsylvania State College. Power, vol. 66, no. 2, July 12, 1927, pp. 54-55, 3 figs. Details of indicator employed.

MECHANICAL INJECTION. Further Developments in Mechanical Injection Oil Engines, O. Wans. Diesel Engine Users' Assn.—Report, no. S78, Apr. 29, 1927, 26 pp., including discussion, 12 figs. Describes those outstanding features that have been mainly instrumental in establishing efficiency and reliability of two- and four-cycle mechanical-injection engines for land purposes.

PRESSURE INDICATORS. The Schweitzer Oil Pressure Indicator, P. H. Schweitzer. Oil Engine Power, vol. 5, no. 7, July 1, 1927, pp. 475-479, 8 figs. Developed primarily to record pressure variations in fuel-injection lines of oil engines, but it can be used without change or with only slight modification for indicating quickly varying fluid pressures of almost any kind, such as cylinder pressures of high-speed internal-combustion engines, gas pressures in gun barrel, explosion in bombs, etc.

SOLID-INJECTION. 275-H.P. Solid-Injection Marine Auxiliary Oil Engine. Engineering, vol. 124, no. 3207, July 1, 1927, p. 12, 1 fig. Details of 5-cylinder engines constructed by Ruston and Hornsby.

OIL FIELDS

Alberta. Turner Valley Oil Area, Alberta, G. S. Hume. Can. Min. Jl., vol. 48, no. 21, May 27, 1927, pp. 433-435. Structure; developments and oil prospects.

OIL FUEL

Synthetic. Processes of Manufacturing Liquid Hydrocarbons for Explosion and Combustion Engines (Les procédés de fabrication d'hydrocarbures liquides pour moteurs à explosion et à combustion, en partant des combustibles minéraux), A. Grebel. Chaleur & Industrie, vol. 8, no. 86, June 1927, pp. 324-332, 2 figs. Describes several methods for making synthetic fuels; it is believed that certain French processes will soon have passed experimental stage.

OXY-ACETYLENE CUTTING

Riser Removal from Castings. Heavy Steel Riser Cutting. Acetylene Jl., vol. 28, no. 12, June 1927, pp. 561-562, 2 figs. Better steel castings can be made where oxy-acetylene cutting torch is used for cutting risers.

OXY-ACETYLENE WELDING

Aluminum Sheets. Welding of Aluminum Sheets Used in the Construction of Pierce-Arrow Bodies. F. E. A. Klein and G. C. Hoff. Am. Welding Soc.—Jl., vol. 6, no. 5, May 1927, pp. 34-36. Advantages of using oxy-acetylene welding process in construction of automobile bodies made of aluminum sheets.

Applications. A Résumé of the Fields of Application Oxy-Acetylene Welding and Cutting, D. S. Lloyd. Toronto Eng. Soc.—Trans., Apr. 1927, pp. 38-48, 11 figs. Describes only those applications of process which have been very successful in reducing cost in the commercial field; deals with production, construction, repair, etc.

Cast-Iron Pipe. Welding Cast-Iron Pipe. Acetylene Jl., vol. 29, no. 13, July 1927, pp. 19-23 and 28. Investigation of bronze-welded lines shows need of careful laying procedure and desirability of expansion joints at 100-foot intervals.

Materials for. Selection of Materials for Welding, E. E. Thum. Am. Welding Soc.—Jl., vol. 6, no. 5, May 1927, pp. 38-43. For good results in oxy-acetylene welding, as in any other activity, it is necessary to select raw materials on which to work; some low-carbon steels are not satisfactory for welding; these steels boil with more or less violence when melted under oxy-acetylene flame, throwing off great many sparks at times.

Steel Furniture. Quality Steel Furniture Gas Welded. Acetylene Jl., vol. 28, no. 12, June 1927, pp. 554-557, 13 figs. Manufacturer of hospital equipment has developed welding as an essential process in production of strong and durable steel furniture.

Tanks. Oxy-Acetylene-Welded Construction of a Large High-Pressure Storage Tank, H. E. Rockefeller. Am. Welding Soc.—Jl., vol. 6, no. 5, May 1927, pp. 16-23, 12 figs. Construction of ethylene storage tank, constructed for Carbide and Carbon Chemicals Corp.; method of welding tank.

P

PAPER

Testing. Committee Report on Standard Testing Methods, M. A. Krimmel. Tech. Assn. & Pulp & Paper Industry—Tech. Papers, no. 1, June 1927, pp. 78-79. Outline of policies of committee on standard methods; form and sequence of subtitles in methods of test; apparatus, test specimen, procedure, etc.

PAPER MACHINERY

Calender Rolls. Calender Rolls. Paper Trade Jl., vol. 84, no. 25, June 23, 1927, pp. 45-51, 13 figs. Roll grinding; measuring crown; amount of crown required; effect of heat on rolls; effect of water finishing and of rusting; grinding wheels.

Rubber-Covered Rolls. Rubber in Paper Machinery. India Rubber World, vol. 76, no. 4, July 1, 1927, pp. 190-192, 6 figs. Use of rubber-covered rolls.
Care and Study of Rubber Rolls. Paper Industry, vol. 9, no. 3, June 1927, pp. 419-422, 2 figs. Use of testing instruments to maintain uniform pressing.

PAPER MANUFACTURE

Asphalt Filled Board. The K-B Process, H. C. Avery. Paper Trade Jl., vol. 84, no. 22, June 2, 1927, pp. 69-70. History and development from theory to common mill practice of K-B process for manufacture of asphalt-filled board on paper machine as conducted in several of largest mills of country.

Beating. A Study of the Beater, S. Milne. Paper Trade Jl., vol. 84, no. 24, June 16, 1927, pp. 54-57. Comparison of small and large beaters; wet beating; circulation in beater; roll speed and power consumption; power losses due to circulation; adjustment of roll and beating pressure.

Bleached Sulphate vs. Sulphite Pulp. Bleached Sulphate vs. Sulphite Pulp, H. A. Helder. Paper Trade Jl., vol. 84, no. 22, June 2, 1927, p. 89. Results obtained throughout test runs with bleached sulphate pulp compare most favorably with average sulphite pulp and undoubtedly indicate that former can be substituted for latter in many respects to considerable advantage, both in quality of resulting product and cost.

Pulping. A Semi-Chemical Pulping Process, J. D. Rue, S. D. Wells, F. G. Rawling and J. A. Staidl. Tech. Assn. & Pulp & Paper Industry—Tech. Papers, no. 1, June 1927, pp. 90-93. Process consists essentially in: (1) pressure impregnation of chips with cooking liquor; (2) mild digestion of chips with chemicals which are practically neutral; and (3) mechanical reduction of softened chips to pulp.

Waste-Liquor Utilization. Sulphite Waste-Liquor Utilization Problems, W. E. B. Baker. Paper Trade Jl., vol. 84, no. 22, June 2, 1927, pp. 77-80. Real solution of sulphite-liquor problem depends on chemical conversion of it into some types of products extensively needed to accelerate already highly accelerated progress of civilization; sulphite liquor originated in soil, and it seems most logical to replace it as directly as possible, hence suggested use in agriculture.

PAPER MILLS

Electric Drive. Electric Power at Provincial Paper Mills, Port Arthur, H. E. Stafford. Elec. News, vol. 36, no. 11, June 1, 1927, pp. 27-32, 14 figs. Nearly 16,000 h.p. used; 254 motors of various types and drives, ranging in size up to 1,400 h.p.

PATENTS

Simplifying Methods. Simplifying Methods of Procedure in United States Patent Office, L. W. Wallace. Soc. Indus. Engrs.—Bul., vol. 9, nos. 5-6, May-June 1927, pp. 21-23. Recommendations of Committee on Patent Office Procedure appointed by Secretary of Department of Interior to make thorough review of Patent Office, with view of simplifying method of procedure and expediting handling of applications for patents.

PATTERNMAKING

Cost Reduction. How to Cut Pattern Costs, D. A. Hampson. Can. Machy., vol. 37, no. 25, June 23, 1927, p. 19. Method of obtaining patterns at low cost in plants that do not require services of patternmaker more than 25 per cent of time.

Designing, Relation to. Patternmaker and Designer: Some Practical Notes on Their Relationship, B. Shaw. Mech. World, vol. 81, no. 2109, June 3, 1927, pp. 395-396. Discusses to what extent chief draughtsman should supervise pattern shop.

PATTERNS

Equipment. Recommended Pattern Equipment. Foundry, vol. 55, no. 13, July 1, 1927, data sheet. Marking gauged surfaces and locating points on patterns; markings indicating chilled surfaces and metal inserts; colour ingredients of coating materials for marking patterns; pattern letters; loose pieces for pattern and core boxes; core prints for metal patterns.

PAVEMENTS, ASPHALT

Mixtures. Aggregate Affects Stability of Asphalt Mixtures, V. Nicholson. Cement, Mill & Quarry, vol. 30, no. 12, June 20, 1927, pp. 29-33. Shows that there is vast difference in sands from different parts of country as affecting stability in asphalt pavements. Paper read before Fifth Asphalt Paving Conference, together with additional material heretofore unpublished.

Voidage in Mixtures. Voidage in Asphalt Paving Mixtures, G. Abson. Can. Engr., vol. 52, no. 21, May 24, 1927, pp. 541-542. Voidage theory in practice, with special reference to shear strength methods of testing; relation of filler to shear strength. Paper presented at Asphalt Paving Confrence.

PIERS

Construction. Engineering Side of Pier Construction, C. R. Thompson. Engrs. & Eng., vol. 44, no. 6, June 1927, pp. 147-150. Describes construction of Municipal Pier No. 80, South Delaware wharves, in course of construction near foot of old Jackson street, on Delaware river; structure is one unit of battery of pier terminals forming what is known as upper group of Moyamensing piers, which occupies 2,250-ft. stretch of waterfront along Delaware river between McKena and Porter streets.

PISTON RINGS

Packing Action. Improved Ring Tester and the Packing Action of Piston Rings. Soc. Mech. Engrs. Japan—Jl., vol. 30, no. 121, May 1927, pp. 205-235, 6 figs. Deals with further researches carried on with ring tester developed by authors; number of tests made on sample pieces of piston rings shows how irregular pressures on cylinder wall are distributed. (In Japanese.)

PISTONS

Thermal Conductivity. Thermal Conductivity of Pistons, C. R. Butler and H. A. Huebotter. Oil Engine Power, vol. 5, no. 6, June 1927, pp. 399-400. Outline of principles of heat flow in piston design.

PLATINUM

Geology of Metals. Geology of the Platinum Metals, J. H. L. Vogt. Economic Geology, vol. 22, no. 4, June-July, pp. 321-325, 1 fig. The ore deposits carrying noteworthy contents of platinum (or platinum metals) are with some few exceptions formed by magmatic concentration; yet minute amounts, especially of palladium and platinum, are also present in other genetic classes of ore deposits.

PORTS

Engineering Aspects. Economics of Engineering in Port Development, M. A. Long. Engrs. & Eng., vol. 44, no. 6, June 1927, pp. 151-153. Compared to European ports, American ports need to consider more extended use of mechanical equipment for reducing expense of handling cargo as well as for expediting release of ships and cars.

PRESSWORK

Blanking and Punching. Pressures for Blanking and Punching, C. W. Lucas. Forging-Stamping-Heat Treating, vol. 13, no. 4, Apr. 1927, pp. 129-131 and 143, 6 figs. Study of power required to overcome resistance to shearing; formula for calculating power necessary.

PROSPECTING

Electrical. Practical Points on Electrical Prospecting, H. Lundberg. Min. & Met. Soc. of Am., vol. 20, no. 3, Apr.-May 1927, pp. 56-60. Deals with following questions: (1) what is field for electrical prospecting?; (2) what is relative expense for electrical prospecting, compared to other methods?; (3) in what way are electrical prospecting methods going to be useful to mining industry?; (4) will it be possible in future for everybody to operate electrical prospecting?

PULVERIZED COAL

Boiler Firing. Powdered Fuel and Its Effect on Boiler Plant Practice, W. J. Cotterell. S. African Inst. Elec. Engrs.—Trans., vol. 18, part 4, Apr. 1927, pp. 62-69. Reply to discussion of paper published in June issue of same journal.

Central Stations. The Use of Pulverized Fuel at the Big Sioux Station of the Sioux City Gas and Electric Company, K. M. Irwin. Mech. Eng., vol. 49, no. 7, July 1927, p. 763. Account of experiences since put into operation in June 1925.

Combustion and Furnace Design. Combustion of and Furnace Design for Powdered Coal, T. A. McGee. Paper Mill, vol. 50, no. 22, May 28, 1927, pp. 18 and 83-84. Selection and burning of coal, hydro-carbon, carbon and CO_2; combustion rates and furnace volumes; furnace water cooling.

Textile Mills. Ability of Pulverized Coal to Meet Varying Loads is Factor of Importance to Textile Mills, C. I. Hubbard. Textile World, vol. 72, no. 1, July 2, 1927, pp. 71-76, 12 figs. Unit-system equipment, form and volume of furnace, ash disposal, efficiency tests, safety precautions.

Unit Mills. Pulverized Coal in the Middle West, E. H. Tenney. Mech. Eng., vol. 49, no. 7, July 1927, pp. 763-764. Experiences with unit mills.

PUMPS, CENTRIFUGAL

Characteristics. Characteristics of Centrifugal Pumps, H. J. Meeker. Refrig. Eng., vol. 14, no. 1, July 1927, pp. 1-7 and (discussion) 7-8, 9 figs. Gives essence of what refrigerating engineer finds it valuable to know about centrifugal pumps; characteristics of pumps; effects of variables, head, speed, impeller diameter as to selection of proper units in size and type and as to determination of what is to be expected of pump run under changed conditions; viscosity and kinds of materials are mentioned.

Worthington. New Centrifugal Pumps Surpass Previous Efficiency Records, W. Schwanhausser. Eng. News Rec., vol. 98, no. 25, June 23, 1927, pp. 1015-1017, 3 figs. Detroit units show overall efficiencies of 84.7 per cent for 50-M.G.D. and 82.8 per cent for 70-M.G.D. unit; supplementary notes on Detroit pumps by W. C. Rudd.

R

RECTIFIERS

Mercury-Arc. Steel-Tank Mercury-Arc Rectifiers, E. B. Shand. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 6, June 1927, pp. 597-602, 5 figs. Work done by Westinghouse Electric & Mfg. Co. on large steel-tank rectifiers between years 1908 and 1918.

REFRIGERANTS

CARBON ANHYDRIDE. Carbon Anhydride as a Substitute for Ice (L'anhydride carbonique succédané de la glace hydrique), R. Villers. Nature (Paris), no. 2761, May 15, 1927, pp. 458-460, 2 figs. Points out that carbon anhydride compressed on liquefied, is refrigerant which can replace ice; it is stored in steel bottles equipped with bronze valves.

SMALL UNITS FOR. Comparison of Various Refrigerants for Small Units, J. R. Hornaday. Refrig. Eng., vol. 13, no. 12, June 1927, pp. 363-364. Items which must be considered in design of unit and in selection of particular refrigerant are total piston displacement per hour necessary to produce required refrigeration under same conditions of evaporator and condensing temperature, and speed, efficiency and stroke of compressor; presents chart giving comparison of various refrigerants.

REFRIGERATING MACHINES

GAS-FIRED. The Gas-Fired Refrigerator, F. E. Sellman. Eng., vol. 14, no. 1, July 1927, pp. 9-12, 6 figs. Deals with continuous-type machine made in United States particularly for application to domestic refrigerator box.

HOUSEHOLD. The Household Machine from Engineering Standpoint, J. E. Starr. Ice & Refrigeration, vol. 72, no. 6, June 1927, pp. 564-565. Operating cost of small machines; analysis of performance of compression type, belt driven from electric motor; test record of well-constructed machines made by reliable manufacturers under favorable conditions with skilled attention.

REFRIGERATING PLANTS

BRONX TERMINAL, NEW YORK CITY. Bronx Terminal Market Refrigerating Plant, A. C. Lescarboura. Power Plant Eng., vol. 31, no. 12, June 15, 1927, pp. 689-692, 5 figs. Municipal project of City of New York will be served by refrigerating plant, already installed, having many interesting design features.

WELDING. All Welded Refrigeration System. Welding Engr., vol. 12, no. 6, June 1927, pp. 31-32, 5 figs. Welding properly applied proves thoroughly reliable for fabrication of most intricate pipe shapes and assemblies.

REFRIGERATION

PACKING PLANTS. Mechanical and Refrigerating Equipment for Model Packing Plant, J. M. Lenone. Refrig. World, vol. 62, no. 6, June 927, pp. 17-18 and 26. Deals with improvements in boiler room, engine room, ammonia condenser, cooling tower, brine storage tank, etc.

PROBLEMS. Refrigeration Data and Problems. Power Plant Eng., vol. 31, no. 14, July 15, 1927, pp. 788-791, 2 figs. Balancing compressor power and condenser-water costs; liquefaction of CO_2; comparison of standard flow meters; moisture and heat transmission in insulating material. Abstract of paper presented before Am. Soc. of Refrig. Engrs.

RESERVOIRS

EMBANKMENTS, CEMENTATION. Cementation of Strata Below Reservoir Embankments, A. A. Barnes. Water & Water Eng., vol. 29, no. 342, June 20, 1927, pp. 215-222, 3 figs. Description of methods which have actually been adopted.

LEAKAGE PREVENTION. Recent Works for the Prevention of Leakage from the Reservoir of Foix (Province of Barcelona) [Nota acerca de los recientes trabajos de impereabilizacion ejecutados en el pantano de Foix (Provincia de Barcelona)], E. G. Granda. Revista de Obras Publicas, vol. 75, no. 3, Feb. 1, 1927, pp. 41-47, 11 figs. To stop very serious leakage from this reservoir, which is underlaid with an argillaceous limestone, it was necessary to seal rock seams, to line canyon walls and to pave bottom areas; concrete largely used in these works.

RIVETS

AIRCRAFT CONSTRUCTION. A New Rivet for Aircraft Construction. Mech. Eng., vol. 49, no. 7, July 1927, p. 726, 1 fig. New type invented by J. W. Iseman.

RIVETED JOINTS

BOILERS. Calculation of Riveted Joints in Steam Apparatus, Especially of Lap Joints (Assemblages par rivure dans les appareils à vapeur et en particulier de ceux à récouvrement), M. V. Kammerer. Annales des Mines, no. 11, Apr. 1927, pp. 219-263, 15 figs. Proposes standardization of calculating methods, and points out importance of considering bending forces in riveted joints, especially lap joints.

ROADS, CONCRETE

QUALITY CONTROL OF CONCRETE. Quality Control of Concrete for Pavements and Foundations, Including Brief Review of the Impact Studies of the Bureau of Public Roads, F. H. Jackson. Engrs. & Eng., vol. 44, no. 5, May 1927, pp. 122-128, 3 figs. Discussion of ways and means for improving quality of concrete used in pavements and foundations.

STRESSES IN. Analysis of Stresses in Concrete Roads Caused by Variations of Temperature, H. M. Westergaard. Pub. Roads, vol. 8, no. 3, May 1927, pp. 54-60, 5 figs. Supplements previous paper by writer, published in Pub. Roads, Apr. 1926, under title, "Stresses in Concrete Pavements Computed by Theoretical Analysis"; it rests upon assumption that concrete pavement acts as homogeneous elastic solid, and, as in form analysis, method is that of theory of elasticity, conclusions being drawn from simple physical laws by mathematical analysis.

ROLLING MILLS

BEARINGS. Anti-Friction Bearings on Roll Necks of Rolling Mills, E. C. Gainsborg. Iron & Steel Engr., vol. 4, no. 6, June 1927, pp. 274-276. There are certain outstanding advantages that use of anti-friction bearings offer, which are not had in plain bearings; these are control of gauge thickness, brought about because of close tolerance to which ball and roller bearings are manufactured; speed of operation can be increased without undue heating.

Application of Tapered Roller Bearings on Roll Necks of Rolling Mills and Pinion Stands, F. Waldorf. Iron & Steel Engr., vol. 4, no. 6, June 1927, pp. 265-271, 8 figs. Results of tests on three-high 22-in. bar mill roughing stand which is used to roll alloy steel; results show possibility of very considerable savings in power by use of roller bearings.

Bearings for Use in Rolling Mills, C. J. Klein. Iron & Steel Engr., vol. 4, no. 6, June 1927, pp. 271-274, 5 figs. Simplicity of design in mounting of roller bearings is also worthy of note; diagrammatical sketches giving idea of different mountings of mill-roll bearings.

Factors Governing the Design of Roller Bearings for Roll Necks, F. H. Buhlman. Iron & Steel Engr., vol. 4, no. 6, June 1927, pp. 302-307, 3 figs. Design of bearing; computation of stresses acting on bearing.

ROUGH SHEET AND TIN ROLLS. Rough Sheet and Tin Mill Rolls, W. R. Kneeland. Iron Age, vol. 120, no. 1, July 7, 1927, p. 13. "Tuesday" roughness explained as due to "crazing" of roll's surface; cause and remedies.

SHEET MILLS. Exceeds Ton of Sheets Per Minute. Iron Age, vol. 119, no. 24, June 16, 1927, pp. 1731-1737 and 1792, 5 figs. Armco continuous mill at Ashland, Ky., is epoch-making as to productivity and unique in incorporating rolling principles established by special research; equipment for continuous production of sheet. See also description in Iron Trade Rev., vol. 80, nos. 24, 25, 26, and vol. 81, nos. 1 and 2, June 16, 23, 30, July 7 and 14, 1927, pp. 1532-1535, 1593-1596, 1656-1659, 8-12 and 67-70; and Mfrs'. Rec., vol. 91, no. 24, June 16, 1927, pp. 73-77.

Sheets Rolled to 16-Gauge on Three-High Backup Mill, J. D. Knox. Iron Trade Rev., vol. 80, no. 26, June 30, 1927, pp. 1656-1659. Skew type feed table and side guides enforce straight-line movement to piece in transit between stands.

STRIP MILLS. Rolling Stripsheets on New Continuous Mill, J. D. Knox. Iron Trade Rev., vol. 80, no. 20, May 19, 1927, pp. 1271-1275, 9 figs. Practice followed in manufacture of strip sheet by Columbia Steel Co.

ROOF TRUSSES

STEEL MEMBERS. Some Problems in the Design of Steel Roof Truss Members, A. G. Pugsley. Structural Engr., vol. 5, no. 6, June 1927, pp. 185-195, 10 figs. Consideration of bending actions which often occur, such as lateral on rafters, eccentricity of riveting, non-intersection of axes of members at joints, rigidity of joints and deformation of truss under load; practical method of roof-truss design which will take such effects into account.

RUBBER

MANUFACTURE. Compounding Troubles in Rubber Manufacture, E. B. Warren. Rubber Age, vol. 8, no. 4, June 1927, pp. 150-162. Deals with those variations and properties of ingredients not usually shown by laboratory examination, and with difficulties arising from interaction possible between several constituents of individual mixing, and of their action on rubber constituents themselves.

S

SAW MILLS

WASTE UTILIZATION. Converting Sawmill Waste Into Profits, S. D. Kirkpatrick. Chem. & Met. Eng., vol. 34, no. 6, June 1927, pp. 343-346, 8 figs. How steam-explosion process developed by W. H. Mason makes synthetic insulating lumber and pressed wood board from waste materials which were formerly burned as trash.

SAWS

CUTTING SPEEDS. Sawing Sections, C. Steele. Mech. World, vol. 81, no. 2112, June 24, 1927, pp. 443-444, 13 figs. In addition to varying sections and given speed of cut, three other factors must be taken into consideration, as they affect feed proportionately; diameter of saw, depth of section and distance of traverse.

HACK. A Universal Hack-Saw Machine. Engineering, vol. 123, no. 3204, June 10, 1927, pp. 715-716, 4 figs. Striking features of machine constructed by R. Price & Sons are revolving table and horizontal cross traverse; former enables work to be sawn at any angle; latter permits cuts to be made in succession.

SHAFT SINKING

GROUTING. Grouting Methods Employed in Sinking the Harwick Coal & Coke Company Shaft, E. T. Gott. Min. Congress Jl., vol. 13, no. 6, June 1927, pp. 480-482. Construction joints weak point in concrete shaft lining; grouting accomplished with weak solution under low pressure graduated to thick cement under high pressure; success dependent upon maximum introduction of heavy grout.

SHAFTS

MULTIPLE-SPLINED. Torsional Strength of Multiple-Splined Shafts, C. W. Spicer. Soc. Automotive Engrs.—Jl., vol. 20, no. 6, June 1927, pp. 739-742, 6 figs. Results of tests show that torsional strength of multiple-splined shaft is considerably less than that of plain round shaft of diameter equal to base diameter of splined shaft; however, elastic limit of shaft supported by hub member, as in case of permanent fitting, is considerably higher than in shaft not so supported; dimensional details of specimens stress-strain curves and brief discussion of results. See reference to previous article by author in Eng. Index 1921, p. 473.

SILOS

REINFORCED CONCRETE. Rapid Construction of Concrete Silos. Engineering, vol. 123, no. 3204, June 10, 1927, pp. 712-713, 8 figs. partly on p. 706. Chief interest lies in adoption of continuous system of shuttering during construction by which reinforced-concrete walls, nearly 80 ft. in height, were completed in fortnight in an English winter.

SOIL

CLASSIFICATION. Principles of Final Soil Classification, C. Terzaghi. Pub. Roads, vol. 8, no. 3, May 1927, pp. 41-53, 15 figs. Data on which it is proposed that final soil classifications be based give information about following properties of subgrade: (1) volume change produced by change of external pressure load which acts on soil, compressibility and elasticity of soil; (2) speed with which volume change follows change of pressure; (3) permeability of soil; (4) volume change due to drying and wetting under standard conditions; (5) consistency of soil in two extreme states.

STANDARDIZATION

ELECTRICAL INDUSTRY. Standardization Policy Outlined, C. C. Chesney. Elec. World, vol. 90, no. 1, July 2, 1927, pp. 5-6. Place of Inst. of Elec. Engrs. in making of national and international standards; should carry on until national and international status is improved.

POLICY AND PROCEDURE. Methods, Money and Management, W. McClellan. Elec. World, vol. 89, no. 25, June 18, 1927, pp. 1325-1328. Standards are useful only to buyers and sellers; policy and procedure in national and international standardization; strengthening of Am. Eng. Standards Committee urged.

PROGRESS. Ten Years of Standardization, 1916-1926 (Tien jaren Normalisatie, 1916-1926), B. M. Gratama. Ingenieur, vol. 42, no. 19, May 7, 1927, pp. 408-415, 2 figs. Organization of standardization work in Holland; financial report; list of standards published and in course of preparation.

STAYBOLTS

LOCOMOTIVE BOILER FIREBOXES. Best Methods of Applying Staybolts to Fireboxes of Locomotive Boilers. Boiler Maker, vol. 28, no. 6, June 1927, pp. 173-175. How holes are tapped; how staybolt taps are purchased as to size; how staybolt taps are gauged.

STEAM

HIGH-PRESSURE. Super-Pressure Steam and Its Effect on the Economy of Generation, T. Roles. World Power, vol. 8, no. 43, July 1927, pp. 29-36, 4 figs. Higher steam pressures and temperatures.

STEAM ENGINES

GOVERNING. Steam Demands Control Engine Operation, C. H. S. Tupholme. Power Plant Eng., vol. 31, no. 14, July 15, 1927, pp. 778-779, 2 figs. New method of governing steam engines enables cut-off to be controlled either by electrical load or by demands for process steam as conditions demand.

RECIPROCATING. A New Type of Steam Engine, C. Commentz. Shipbldr., vol. 34, no. 202, June 1927, p. 331. Engine is of reciprocating type and is noteworthy on account of very low values of fuel and steam consumption figures obtained.

Uniflow. Uniflow Marine Engine with Oil-Operated Valve Gear. Engineer, vol. 143, no. 3728, June 24, 1927, pp. 676-679, 13 figs. Constructed by Sulzer Bros. for paddle-wheel steamer Helvétie; it is 3-cylinder engine developing 1,500 b.h.p.; old methods of lubrication have been replaced by centrally forced lubrication system.

STEAM PIPES

Design. Modern Pipe-Work Design, G. H. Willett. Elec. Times, vol. 71, no. 1858, June 2, 1927, pp. 760-764, 13 figs. Deals with cast iron; steel castings; riveted pipes; welded tubes; weldless tubes; joints; welded-on and riveted-on flanges; welded joints; velocities; expansion; valves; drainage; insulation and corrosion.

STEAM POWER PLANTS

Block of Buildings for. A Successful Block Power Plant. Power, vol. 66, no. 1, July 5, 1927, pp. 19-20, 1 fig. Data on Cincinnati power plant supplying light, heat and power to block of buildings; during summer months energy is purchased from public utility and retailed.

Design. Recent Development in Power Plant Design, T. Roles. Elecn., vol. 98, no. 2557, June 3, 1927, pp. 605-609. Their effects on economy of generation; adoption of higher steam pressures and temperatures; preservation of furnace walls.

Diesel-Engined. The Private Diesel-Engine Generation Station. Oil Eng. & Technology, vol. 8, no. 4, Apr. 1927, pp. 145-147. Economical generation of electrical power by heavy-oil engines.

India. Impressions of a Native Engineer in an Indian Power Plant, P. P. Talaty. Power, vol. 66, no. 1, July 5, 1927, pp. 11-12, 4 figs. Details of plant which generated power for cotton mill, with both steam and Diesel engines; operating record was equal to that of any corresponding American or European mill; in fact, fuel consumption of Diesel was better than that obtained in European tests.

Industrial. Operating Costs of Industrial Plants, C. S. Gladden. Power Plant Eng., vol. 31, no. 13, July 1, 1927, pp. 724-726. Cost comparisons and methods of reducing power-plant costs.

Use of Power in Industrial Plants. Power Plant Eng., vol. 31, no. 14, July 15, 1927, pp. 775-778. Modernization of plants, changes due to electric drive and considerations on boiler-furnace design.

Oil-Engined. The "Watch Tower" Model Oil Engine Power Plant. Oil Engine Power, vol. 5, no. 6, June 1927, pp. 381-385, 8 figs. Bible and Tract Society uses oil-engine power exclusively in their publishing plant; plant auxiliaries; foundation and piping; cooling system.

Performance Data. Steam Plant Operation Data. Elec. West, vol. 58, no. 6, May 15, 1927, pp. 376-379, 11 figs. Heat balance; measurement of fuel oil. Prime Movers' Committee report to Pac. Coast Elec. Assn.

Waste-Fuel Burning. Steam for Power, Heat and Process Generated by Waste Fuel. Power, vol. 66, no. 2, July 12, 1927, pp. 42-44, 5 figs. Operation of new plant proves economical; full capacity factory operation produces balance between waste fuel available and steam required; new plant occupies same space as old.

STEAM TRAPS

Design. Some Considerations of Steam Trap Design, R. W. Watts. Combustion, vol. 16, no. 6, June 1927, pp. 339-340. Perhaps principal difficulty is not so much failure of trap to remove condensate as failure to stop when condensate has been removed without permitting expensive losses of live steam; advantages of quick-action positively operating valve mechanisms.

STEAM TURBINES

Extraction. Calculating Performance of Extraction Turbines, B. M. Thornton. Power Plant Eng., vol. 31, no. 12, June 15, 1927, pp. 669-671, 2 figs. Steam requirements for stage feedwater heating by steam extracted from main unit can be easily found and thermal efficiency of cycle and increase in thermal efficiency over non-extraction cycle determined.

Oil Reconditioning. Is It Necessary to Renew Turbine Oil? S. S. Dougherty. Power Plant Eng., vol. 31, no. 13, July 1, 1927, pp. 721-723, 4 figs. System of turbine-oil reconditioning as used at Acme plant of Toledo Edison Co. proves satisfactory.

Stuffing Boxes. Stuffing Boxes for Steam Turbines. Eng. Progress, vol. 8, no. 5, May 1927, pp. 135-136, 3 figs. All drawbacks of old carbon and labyrinth packings are avoided by new corrugated spring packing manufactured by Gustav Huhn, of Berlin.

Test Corrections. Impulse Steam Turbine Test Corrections, S. B. Jackson. Elec. Times, vol. 71, no. 1858, June 2, 1927, pp. 764-766, 4 figs. Leaving losses; correction of pressure; temperature-variation correction; vacuum; speed and total correction.

STEEL

Proportional Limit. Determining the Proportional Limit of Steel, B. Kjerrman. Am. Soc. Steel Treating—Trans., vol. 12, no. 1, July 1927, pp. 41-45. In multiple-screw tensile-testing machines eccentric pull on specimens is frequently experienced and involves source of error, especially when determining proportional limit by means of Martens mirror extensometer; in order to obtain correct proportional limit from load-deflection data, author proposes method of calculating elongation of specimen corresponding to one load increment of about 1 or 2 kg. per sq. mm., assuming for steel modulus of elasticity of 28,400,000; in test, limit thus found was same, whether load has been increased in many or in few steps, final load increments in both cases being same.

STEEL CASTINGS

Flaws, Prevention of. Prevent Flaws in Steel Castings, J. L. Gibney. Foundry, vol. 55, no. 13, July 1, 1927, pp. 526-529, 19 figs. Cavities may exist in steel castings and never appear until casting fails under severe load or test; in writer's opinion, introduction of nails affords most satisfactory solution to problem; reports from many sources indicate that chill nails are used extensively both in green-sand and dry-sand moulds.

STEEL, HEAT TREATMENT OF

Annealing. Annealing and Its Importance in Steel Treating, B. F. Davis. Iron Trade Rev., vol. 80, no. 25, June 23, 1927, pp. 1589-1592, 7 figs. Annealing may be given seven classifications, according to its purpose, each of which is discussed.

Hardening. Hardening of Intricate Work, H. Simon. Machy. (Lond.), vol. 30, no. 765, June 9, 1927, p. 292.

Hardening and Tempering. The Decomposition of the Austenitic Structure in Steel, O. E. Harder and R. L. Dowdell. Am. Soc. Steel Treating—Trans., vol. 12, no. 1, July 1927, pp. 51-63 and (discussion) 63-68.

Quenching. A Neglected Phenomenon in Heat Treatment, B. Egeberg. Am. Soc. Steel Treating—Trans., vol. 12, no. 1, July 1927, pp. 46-50.

STRUCTURAL STEEL

Gunite Incasement. Result of Gunite Incasement on Structural Steel, B. C. Collier. Engrs'. Soc. West. Pa. Proc., vol. 43, no. 1, Feb. 1927, pp. 80-87 and (discussion) 87-102. Proves that structural steel incased in gunite fulfils all conditions.

SUBSTATIONS

Automatic. Testing, Inspecting and Maintaining Automatic Stations, C. Lichtenberg. Am. Inst. Elec. Engrs. Jl., vol. 46, no. 6, June 1927, pp. 603-606. General guide for inspection and maintenance practice in automatic stations; suggests in broad way how these duties should be performed; this should be helpful in drawing up definite schedules for particular stations. Bibliography.

T

TIDAL POWER

Plants. Application of Thury Distribution System by Direct Current with Constant Intensity in the Scheme for a Tidal Power Plant at Frenaye, France [L'application du système de distribution Thury par courant continu à intensite constante au project d'usine marémotrice de la Frenaye (Cotes-du-Nord)], L. Schwob. Génie Civil, vol. 90, no. 21, May 21, 1927, pp. 500-504, 6 figs. Problem of utilization of tides, hitherto only theoretically treated, will be realized in construction of tidal electric plant; estimated cost, 630 million francs; dam with storage capacity of 20 million sq. m. of water at average height of 35 m. above bay level.

TRACTORS

Suction-Gas. Suction Gas Tractor with Parker Producer Hauling 3-Furrow Plough, P. Brotherhood and J. and F. Howard. Engineer, vol. 144, no. 3730, July 8, 1927, p. 37, 2 figs. Account of plowing trial at Perivale, England, to demonstrate practicability of using charcoal fuel on agricultural tractors.

V

VALVE GEARS

Four Valves Per Cylinder. A New Valve Gear. Automobile Engr., vol. 17, no. 229, June 1927, p. 226, 1 fig. Operating mechanism for four valves per cylinder; design produced and patented by A. H. Wilde, of Hotchkiss Automobile Co. of Paris; combines advantages of reduced overall height while leaving space necessary for mounting intake and exhaust manifolds.

VALVES

Hydro-Electric Plants. Erection of Large Johnson Valve, L. H. Burpee. Can. Engr., vol. 52, no. 25, June 21, 1927, pp. 603-606, 7 figs. General principle of operation of Johnson valve; water-power-plant penstocks equipped with 16-ft. valves; erection of valve in power house; placing plunger inside valve.

VANADIUM

Properties. Vanadium, F. W. Mardena and M. N. Rich. Indus. & Eng. Chem., vol. 19, no. 7, July 1927, pp. 786-788, 1 fig. Vanadium metal has been prepared; contrary to previous statements in literature, this metal is not like arsenic or bismuth; it is not brittle, but may be cold-worked into wire or other forms; physical properties, such as specific gravity, electrical conductivity, etc., have been determined; in properties, vanadium resembles tantalum.

VENTILATION

Air Currents. Air Currents for Ventilation, T. N. Thomson. Plumbers' Trade Jl., vol. 83, no. 1, July 1, 1927, pp. 22-25. How to secure proper distribution of fresh air to rooms for ventilation purposes.

Future Prospects. The Future of Ventilation, C. F. Wolfsfeld. Heat. & Vent. Mag., vol. 24, no. 6, June 1927, pp. 55-57, 3 figs. Importance of selling idea to public with suggested method for duplicating mild outdoor conditions.

Piping. Bends in Ventilation Piping, R. A. H. Flugge-de-Smidt. Chem. Met. & Min. Soc. of S. Africa—Jl., vol. 27, no. 9, Mar. 1927, pp. 193-194, 1 fig. While installing system of 20-in. galvanized ventilating pipe it was brought home to author how very much more expensive curved piping was than straight lengths; by having straight lengths cut off at certain angles it was found possible to negotiate all various twists and turns, and, as piping cut off at angle was only shade more expensive than similar lengths cut square, considerable saving was effected.

Plating Rooms. Pure Air Vital to Platers' Efficiency, W. S. Barrows. Can. Foundryman, vol. 18, no. 6, June 1927, pp. 15-20, 3 figs. Account of author's experience in plating-room ventilation.

Schools. The Mechanical Ventilation of the St. Louis Schools, E. S. Hallett. Heat. & Vent. Mag., vol. 24, nos. 1, 2, 3, 4, 5 and 6, Jan., Feb., Mar., Apr., May and June, 1927, pp. 65-68, 83-85 and 87, 84-86, 79-81 and 84, 73-79 and 73-74, 17 figs.

W

WATER HEATERS

Heat Transfer. Heat Transfer in Tubular Water Heaters, O. E. Frank. Am. Soc. Heat. & Vent. Engrs., vol. 33, no. 7, July 1927, pp. 415-422, 4 figs. Discusses following factors: whether water is to flow through tubes or around them; diameter of tubes; velocity of water if in tubes; allowable pressure drop on water side of heater; proper drainage of heater; elimination of air in steam spaces.

WATER MAINS

Cement-Lined. Cement-Lined Water Mains, H. Y. Carson. Indus. & Eng. Chem., vol. 19, no. 7, July 1927, pp. 781-783, 3 figs. Considers factors in municipal water supplied which contribute to so-called "red water" troubles and discusses value of cement lining for preventing tuberculation and internal corrosion of iron pipes; examples of great durability of some early cement linings as invented and put into use half-century ago in New England; mechanism of corrosion factors of water as they relate to cement-lined iron pipe.

WATER SOFTENING

Recarbonation. Recarbonation of Softened Water, C. P. Hoover. Indus. & Eng. Chem., vol. 19, no. 7, July 1927, pp. 784-786, 4 figs. When water for public supply is softened by lime, certain amount of difficulty results from decomposition of calcium carbonate in filter sand and in pipes; this difficulty is being prevented by adding CO_2 to water before filtration.

WATER TREATMENT

Lake Michigan Water. Preliminary Experiments on the Treatment of Lake Michigan Water for Chicago, J. R. Baylis. Am. Water Wks. Assn. Jl., vol. 17, no. 6, June 1927, pp. 710-726, 7 figs. Experiments at Chicago were started primarily to determine most efficient method of purifying Lake Michigan water; with turbidity with range of from 3 to 100 and averages over 10 for some of intakes, and with pollution that requires fairly heavy dose of chloring, clarity and taste are not all that is desired; deals with problems that will receive consideration in investigation and results of experiments already conducted.

WATER SOFTENING

ADVANTAGES. Water Softening as an Adjunct to Water Purification. C. P. Hoover. Am. Water Wks. Assn.—Jl., vol. 17. no. 6, June 1927, pp. 751-759. Reason why so few softening plants were built; recarbonization and other developments; use of coagulants in softening; zeolite process; operation of lime-zeolite softening plant; differences between water filtration and water softening; advantages of softening. See abstract in Water Works Eng., vol. 80, no. 13. July 6, 1927, pp. 991-992 and 1019-1020, 8 figs.

WATER WORKS

STATISTICAL DATA. Information Concerning Water Works. Pub. Wks., vol. 58, no. 6, June 1927, pp. 224-235. More than 700 water works officials report amounts of pipe laid last year, total lengths in service and numbers of appurtenances set; also equipment used for trenching and backfilling and other labour-saving appliances; more than 80 per cent of plants municipal.

WATT-HOUR METERS

INDUCTION. The Induction Watt-Hour Meter, G. W. Stubbings. Elec. Times, vol. 71, no. 1,860. June 16, 1927, pp. 843-845, 2 figs. Considers in non-mathematical manner elementary theory of induction meter and sources of principal errors to which it is subject.

WATTMETERS

TESTING. Timing Method for Meter Laboratories, O. K. Coleman. Elec. World, vol. 90, no. 1, July 2, 1927, pp. 20-21, 3 figs. Simple, direct method of testing rotating standards and one in general use is by comparison with laboratory standard wattmeter holding constant load on wattmeter; practical means is use of 60-beat pendulum self-winding master clock fitted with contact device to give impulses at definite intervals; impulses from this clock operate relay which closes and opens potential circuit to rotating standard under test.

WELDING

RESEARCH. Welding Research, C. A. McCune. Am. Welding Soc.—Jl., vol. 6, no. 6, June 1927, pp. 39-45, 8 figs. Welding research as carried on in laboratory of Am. Chain Co. occupies attention of five distinct types of people in which are included the engineer, welder, metallurgist, chemist and physicist.

WIRE. Report of the Welding Wire Specification Committee, C. A. McCune. Am. Welding Soc.—Jl., vol. 6, no. 5, May 1927, pp. 44-50, 6 figs. Account of meeting of reorganized Welding Wire Specifications Committee called to determine in what manner, if any, present specifications can be made more rigid so as to further guarantee that welding wire purchased according to these specifications will be satisfactory.

WELDS

RED SHORTNESS. The Red Shortness of Weld Metal, A. H. Goodger. Welding Jl., vol. 24, no. 285, June 1927, pp. 166-169, 8 figs. Trouble is usually due to presence of certain impurities such as sulphur or oxygen, which may give rise to brittle films between grains; fractures are usually intergranular.

WINDING ENGINES

VARIABLE-SPEED-GEAR CONTROL. Variable-Speed-Gear Control for Winding Engines. Colliery Guardian, vol. 83 no. 3466, June 3, 1927, pp. 1296-1297, 2 figs. Explains construction and general principle of operation of these gears.

Z

ZINC

COMMERCIAL APPLICATIONS. Progress in Commercial Applications of Zinc, J. A. Singmaster. Min. & Met., vol. 8, no. 246, June 1927, pp. 250-254, 5 figs. Pure zinc shows properties differing from those of ordinary commercial grade; why die castings crack; new zinc alloys; spangled-sheet fallacy.

Engineering Index

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A

ACCELEROMETERS

Testing Apparatus. Accelerometer Testing Apparatus. Soc. of Automotive Engrs.—Jl., vol. 21 no. 2, Aug. 1927, pp. 121-126, 4 figs. Instrument uses rotating-weight method for obtaining harmonic motion.

ACCIDENT PREVENTION

Engineering and. Engineering—A Factor in Accident Prevention. Nat. Safety News, vol. 16, no. 2, Aug. 1927, pp. 37-40, 1 fig. No. 79 of the series of Safe Practices Pamphlets; reprints of this and other pamphlets of series are obtainable from the headquarters of the Nat. Safety Council in Chicago.

ACCIDENTS

Reduction of Cost of. The Way to Reduce the Cost of Accidents, L. P. Alford. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 121-124, 4 figs. Managers and executives must make safety a major responsibility and continuing care to reduce accident cost; this is conclusion and recommendation of special committee of the Am. Eng. Council which has made study of production and safety in industry.

AERODYNAMICS

Wind Tunnels. The New Aerodynamic Laboratory of the University of Toronto, J. H. Parkin. Engineering Journal, vol. 10, no. 8, Aug. 1927, pp. 390-399, 16 figs. Description of laboratory with results of air-flow studies and power-consumption tests.

AIR

Properties of. Atmospheric Air in Relation to Engineering Problems, H. Eisert. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 33, no. 8, Aug. 1927, pp. 459-465, 1 fig. Humidity calculations in engineering problems.

AIR COMPRESSORS

Tests. Tests of Low-Tension Air Compressors (Les essais de compresseurs d'air à basses pressions), M. L. Lahoussay. Revue de l'Industrie minérale, no. 158, July 15, 1927, pp. 293-305, 12 figs. Theoretical principles of compressor tests. Description of apparatus and procedure of testing efficiency; consumption of water and lubricating oil, and starting process of centrifugal and piston air compressors.

AIR CONDITIONING

Theatres. Air Conditioning in the Theatre, L. L. Lewis. Refrig. Eng., vol. 14, no. 2, Aug. 1927, pp. 55-60 and 88, 5 figs. Sets forth general financial or economic considerations. Each item is considered with respect to cost, and, for purposes of comparison, these costs are balanced against simple plan of ordinary ventilation.

AIRPLANE ENGINES

Friction of. Friction of Aviation Engines, S. W. Sparrow and M. A. Thorne. U.S. Natl. Advis. Com. for Aeronautics, Report No. 262, 1927, 27 pp., 32 figs. Discusses measurements of friction made in altitude laboratory of Bureau of Standards between 1920 and 1926, with reference to influence of speed, barometric pressure, jacket-water temperature and throttle opening upon friction of aviation engines. Deals also with measurements of friction of a group of pistons differing from each other in a single respect, such as length, clearance, area of thrust face, location of thrust face etc.

Revolution Recorder. Engine Revolution Recorder for Aeroplanes. Engineering, vol. 124, no. 3212, Aug. 5, 1927, pp. 168-169, 8 figs. Description of a mechanism used in the Imperial Airways machines which records on a chart engine speeds up to 2,500 r.p.m.

Starting. Starting of Airplane Motors (Le démarrage des moteurs d'aviation), L. Poincaré. Revue industrielle, vol. 57, no. 2217, Aug. 1927, pp. 373-380, 2 figs. Historical review of starting devices and methods. Discussion of modern requirements and principles of starting mechanisms. A general calculation of force required for starting checked by tests on a number of French motors.

AIRPLANES

Long-Range Flight. Long-Range Flight of Airplanes (Sur le vol horizontal d'un avion a grand rayon d'action), M. J. Vorobeitchik and M. P. Painleve. Academie des Sciences—Comptes Rendus, vol. 184, no. 9 Feb. 28, 1927, pp. 514-516. Discusses mathematically optimum conditions for horizontal flight of long-range airplane; certain simplifying assumptions are made, and an expression is found relating consumption with other factors involved.

Spinning of. The Spinning of Aeroplanes, L. W. Bryant. Roy. Aeronautical Soc.—Jl., vol. 31, no. 199, July 1927, pp. 619-681 and (discussion) 681-688, 31 figs. History of spinning problem; consideration of geometry and mechanics of steady spin; in first section, assuming that airplane can be held in steady spiral motion at large mean angle of incidence, authors analyze in geometrical terms airplane's attitude and examine balance of force; they examine various component couples which arise and endeavour to suggest how balance of couples is maintained.

ALLOYS

Aluminum. *See Aluminum Alloys.*

Copper. *See Copper Alloys.*

Corrosion-Resistant. Selection of Corrosion Resistant Alloys, W. M. Mitchell. Forging—Stamping—Heat Treating, vol. 13, no. 6, June 1927, pp. 204-207. Discusses mechanism of corrosion together with factors involved and reviews modern practice in combating destruction of metals.

ALUMINUM

Manufacturing Processes. Acid Processes for the Extraction of Alumina, G. S. Tilley, R. W. Millar and O. C. Ralston. U.S. Department of Commerce—Bur. of Mines no. 267, 1927, 82 pp. Discusses not only sulphuric acid processes of chief interest to us, but also reviews all other work with hydrochloric or nitric acids, in order that comparative advantages can be appreciated.

ALUMINUM ALLOYS

Industrial Uses. Industrial Utilization of Aluminum Alloys (A propos de l'utilisation industrielle des alliages d'aluminium), H. Pommerenke and P. Herman. Revue de Métallurgie, vol. 24, no. 6, June 1927, pp. 297-306, 6 figs. Discusses following questions: What is best light alloy to meet requirements of many industries, particularly automobile and motorcycle industry; what heat treatment is most desirable for this alloy from point of view of efficiency and cost.

Intermediate Hardeners. Intermediate Aluminum Alloys (Hardeners) for Use in Preparing Light Aluminum Alloys, R. J. Anderson. Am. Metal Market, vol. 34, no. 137, July 16, 1927, pp. 4-7, 25 figs. Intermediate aluminum alloys are used extensively in practice as vehicles for making fixed additions of metals to aluminum in preparation of light alloys; in foundry parlance, intermediate alloys are usually referred to as "hardeners" or "rich alloys"; list of intermediate alloys and properties; preparation; microstructures.

AMMETERS

Induction. The Induction Ammeter, F. E. J. Ockenden. Elec. Rev. vol. 101, no. 2592, July 29, 1927, pp. 173-174, 4 figs. Principles involved and means of improving design.

AMMONIUM SULPHATE

Recovery. Direct Gypsum Process of Ammonium Sulphate Recovery, H. W. Jackman. Am. Gas Jl., vol. 127. no. 4, July 23, 1927, pp. 77-80, 1 fig. Report covers work done for Michigan Gas Association during last year on production of ammonium sulphate from gas liquor and gypsum. See also Gas Age Rec., vol. 60, no. 4, July 23, 1927, pp. 107-108 and 116, 1 fig.

ARTILLERY

Anti-Aircraft. Some Random Thoughts on Anti-Aircraft Artillery P. D. Bunker. Coast Artillery Jl., vol. 67, no. 1, July 1927, pp. 5-17, 2 figs. Observations made as result of several years spent in more or less close connection with anti-aircraft artillery.

ASPHALT

Stability Test. Service Trails and the Asphalt Stability Test, P. Hubbard and F. C. Field. Highway Engr. & Contractor, vol. 17, no. 1, July 1927, pp. 45-47, 2 figs. Stability test devised by authors for control of asphalt paving mixtures as compared with actual service tests on New York streets.

AUTOGENOUS WELDING

Aluminum Alloys. Autogenous Welding of Aluminum Alloys Employed in Automobile Construction (Soudure autogene des pieces en alliages d'aluminium employée en construction automobile), J. Bert. Revue de Métallurgie, vol. 24, no. 6, June 1927, pp. 337-344, 3 figs. Results of mechanical tests; influence of preparation of pieces, of temperature and of composition of metal and of heat treatment and cold working.

AUTOMOBILE ENGINES

Acceleration Tests. Engine Acceleration Tests J. O. Eisinger. Soc. of Automotive Engrs.—Jl., vol. 21, no. 2, Aug. 1927, pp. 184-190 and (discussion) 190-192, 12 figs.

Lubrication. Oil-Flow Through Crankshaft and Connecting-Rod Bearings, D. B. Brooks and S. W. Sparrow. Soc. of Automotive Engrs.—Jl., vol. 21, no. 2, Aug. 1927, pp. 127-134, 12 figs.

Piston Speed. The Quest for Higher Piston Speeds, P. M. Heldt. Automotive Industries, vol. 57, no. 5, July 30, 1927, pp. 152-155, 1 fig. Striking proper balance between performance and endurance is problem confronting manufacturers of moderate-priced cars.

AUTOMOBILES

Brakes. Dynamometer Test of Brake-Drum Heat in Dual Wheels C. W. Bedford and E. Blaker. Soc. of Automotive Engrs.—Jl., vol. 21, no. 2, Aug. 1927, pp. 160-169 and (discussion) 169-170, 15 figs. Effect of brake-drum heat on tire temperatures under known conditions of brake-horse power input; report of three months' tests.

The Problem of Brake Adjustment, F. W. Parks. Automotive Mfr., vol. 49, no. 4, July 1927, pp. 21-24. A thoughtful and thorough summary of whole braking problem; advantages and disadvantages of various forms; proper testing.

Headlights. Automobile Headlights (Constitution et alimentation des phares d'automobiles). Industrie Electrique, vol. 36, no. 841, July 10, 1927, pp. 295-304, 13 figs. Deals with following problems: optic projection, importance of standard beam of light, study of lamps, anti-glare devices, lighting of routes and visibility, etc.

AUTOMOTIVE FUELS

BENZOL. *See Benzol.*

FILTERING. Filtering the Fuel, C. T. Schaefer. Bus Age. vol. 7, no. 5, May 1927, pp. 21-24 and 30, 10 figs. The use of fuel filters on motorbus engines and why their use is recommended; various devices and their construction and operation.

AVIATION

AIRPORTS. Recent Developments of Municipal Airports in the West, D. R. Lane. Am. City, vol. 37. no. 1, July 1927, pp. 1-5. 5 figs. San Diego airport; San Francisco temporary flying field; Oakland site; Santa Monica's field; Portland project.

COMMERCIAL. Service Aviation, Aeronautical Engineering and Commercial Aviation. E. P. Warner. Soc. of Automotive Engrs.—Jl., vol. 21. no. 2 Aug. 1927. pp. 151-154. Discusses general question of desirability of specifically commercial type of airplane engine that shall be less refined and less expensive than military types and indicates that safety, reliability and economy are objectives of commercial aviation.

B

BALANCING MACHINES

VIBRATION, ELIMINATION OF. Dynamic Balancing of Rotating Parts, D. Mitchell Duncan. Can. Machy., vol. 38, no. 3, July 21, 1927, pp. 11-13, 5 figs. Discussion of importance of perfect balancing of rotating parts in the elimination of vibration, and explanation of operation of precision balancing machines.

BEARINGS

ELECTRIC MOTOR. An Analysis of the Motor Bearing Problem, F. W. Cramer. Iron & Steel Engr., vol. 4, no. 7, July 1927 pp. 329-332. Advantages of sleeve bearings; shows that sleeve bearings collectively, both in mill manufacture and maintenance, do not make fair comparison with factory-made precision anti-friction bearing, but. from operating standpoint, their simple construction and ease of fabrication by average mechanic are form of insurance against long delays when one fails and spare is not at hand; and also enable mills to carry comparatively low inventory of bearings and bearing material.

BELT DRIVE

IDLERS. Fixed and Flexible Idlers on Leather Belt Drives, R. C. Moore. Indus. Engr., vol. 85. no. 7, July 1927, pp. 310-313, 6 figs. When idler drives are laid out properly and equipped with suitable belts, not only is belt life as long as that on open drive but maintenance and cost of operation are considerably less.

INFLUENCE OF PULLEY DIAMETER. Influence of Pulley Diameter on Power Transmitted by Leather Belt Drives, R. C. Moore. Indus. Engr., vol. 85, no. 8, Aug. 1927, pp. 357-359, 4 figs. Data on minimum pulley diameters for belts transmitting given horsepower.

SLIP. Angular Slip of Pulleys and Slip of Tight and Slack Sides of Driving Belts (Sur le glissement angulaire des poulies et le glissement des brins menant et mené de la courroie). M. Swyngedauw. Académie des Sciences—Comptes Rendus, vol. 183, no. 26, Dec. 1926, pp. 1329-1333. Reports results of numerous experiments showing that pulley slip is always greater than belt slip.

BENZOL

UTILIZATION AS FUEL. Benzol, Its Utilization as Fuel (Le benzol et son emploi comme carburant), M. Bihoreau. Annales de l'Office National des Combustibles Liquides, no. 2, June 1927, pp. 281-308. Notes on different solutions proposed for fuel purposes; available resources; benzol and its mixtures.

BLAST FURNACES

FLUE DUST AND CONTROL. Blast Furnace Flue Dust and Blast Furnace Control, E. Kieft. Iron & Steel Engr., vol. 4, no. 7 July 1927, pp. 345-348, 3 figs. Makes calculations pertaining to cause of flue dust production; importance of necessary height between stock level and centre of downcomers is calculated with consideration of prevailing conditions encountered in practical operation.

LOSSES IN AIR DUCTS. Calculation of Losses in Air Ducts in Blast Furnaces (Calcul des pertes de charge dans les conduites à vent des hauts-fourneaux), M. Derclaye. Revue de Métallurgie, vol. 24, nos. 5 and 6, May and June 1927, pp. 237-254 and 317-330, 14 figs. Determination of loss in rectangular element in circular duct; influence of operating conditions; applications to different types of furnaces.

BLOWERS

FORCED DRAUGHT VS. SUCTION. The Use of Fans for Increasing Draught in Heating Plants (Emploi des ventilateurs pour renforcer le tirage des installations thermiques), F. Prothais. Chaleur & Industrie, vol. 8, no. 87, July 1927, pp. 386-394, 2 figs. Deals with suction blowers and forced draught blowers and comparison of two systems.

BOILER FEEDWATER

PRIMING. The Priming of Saline Waters, A. F. Joseph and J. S. Hancock. Chemistry & Industry, vol. 46. no. 30 July 29, 1927, pp. 315T-321T, 5 figs. Investigations described in this paper were designed to ascertain causes and prevention of priming in locomotive boilers, this being particularly important problem in those parts of the world where supply of water for locomotive steam raising is not only very bad quality, but also limited in quantity.

PURIFICATION. The Purification of Water for Boiler Feed Purposes, T. R. Duggan. Engineering Journal, vol. 10, no. 8, Aug. 1927, pp. 379-385, 6 figs. Review of the various methods of water purification. Paper read before Montreal Branch of the Engineering Inst. of Canada, March 10, 1927.

TREATMENT. Preliminary Purification of Boiler Feedwater (L'épuration préalable de l'eau d'alimentation des générateurs), M. J. Guth. Assns. Françaises de Propriétaires d'Appareils à Vapeur—Bul., no. 28, Apr. 1927, pp. 136-146, 5 figs. Discusses elimination of scale-forming salts and other harmful elements from feedwater before it enters boiler; physical, chemical and combined physico-chemical process.

Zeolite Water Treatment in a Large Central Heating Plant A. H. White, J. H. Walker, E. P. Partridge and L. F. Collins. Am. Water Works Assn.—Jl., vol. 18, no. 2, Aug. 1927, pp. 219-224 and (discussion) 244-249, 9 figs. Zeolite water treatment system in the Beacon street heating plant of the Detroit Edison Co.

BOILER PLANTS

INSTRUMENTS. Operation and Control of Boiler Rooms (Le rôle des analyseurs, des debitmètres, des pyromètres et des pressiodeprimomètres), M. Bouffart. Revue Universelle des Mines, vol. 15, no. 2, July 15, 1927, pp. 49-66, 6 figs. Discusses instruments essential to boiler room, including analyzers, discharge meters pyrometers and pressure-reduction meters.

BOILERS

COKE-FIRED. Coke-Fired Steam Boilers, E. W. L. Nicol. Gas Engr., vol. 43, no. 615, July 1927, pp. 177-178. Draught required for gas coke; mechanical stoking; utilizing low-grade coal; coke-fired power stations.

COMBUSTION. Principles of Combustion in Modern Steam Boiler Practice, D. L. Fagnan. Nat. Engr., vol. 31, no. 7, July 1927, pp. 313-316. Boiler operation in terms of percentage of excess air; radiant heat; heat generation and absorption.

VERTICAL. An Improved Design for Vertical Steam Boilers, N. Wignall. Boiler Maker, vol. 27, no. 7. July 1927, pp. 198-199, 2 figs. Designed to overcome troubles usually encountered; provision of superheater chamber; boiler can be machine-riveted throughout during construction.

BREAKWATERS

PORT ARTHUR, CANADA. Breakwater Extension at Port Arthur, F. Y. Harcourt. Can. Engr., vol. 53. no. 4. July 26, 1927, pp. 161-164, 7 figs. Last extension to rubble mound breakwater at main harbor north is 2,000 ft. long, 14 ft. wide at top and 30 ft. at water line; core of quarry run stone with covering course of large trap rock.

BRICKMAKING

LAMINATION. Lamination—A Scientific Study, J. E. Kirchner. Brick & Clay Rec., vol. 71, no. 2, July 19, 1927. pp. 106-110, 15 figs. Direct cause of lamination is peculiar behaviour of clay molecules; once they are separated from each other they seem to lose their cohesive force; given sufficient time, they seem to regain this force.

BRIDGES, CONCRETE

GIRDER. Bridge at Spadina Avenue, Toronto. Contract Rec. & Eng. Rev., vol. 41, no. 29, July 20, 1927, pp. 716-718, 7 figs. Measuring 896 ft. 8½ in. from face to face of backwalls on abutments and 1,426 ft. 6 in. overall, including approaches, new bridge is through plate girder design in 11 spans, of which longest is 93 ft.; width overall is 86 ft., providing for two 11-ft. sidewalks and two 28 ft. 7 in. roadways, on each of which is street railway track.

BRIDGES, HIGHWAY

PEACE BRIDGE. Erecting the Buffalo-Fort Erie Bridge, T. Earle. Can. Engr., vol. 53, no. 6, Aug. 9, 1927, pp. 197-201. 9 figs. Methods employed in erecting the Peace bridge; design of falsework and operations of traveler; placing steel falsework cribs in river; approximately 9,000 tons of steel in structure.

BRIDGES, STEEL

REPLACEMENT OF VERTICALS. Replacement of Verticals in a 216-Ft. Span Pratt Truss Bridge, H. J. Nichols. Engineering, vol. 124, no. 3209 July 15, 1927, pp. 65-68, 9 figs. Method which proved to be very successful of dealing with results of derailment on through-span bridge.

BUILDING CONSTRUCTION

FOUNDATIONS. Construction of Building Foundations, G. R. Johnson. Can. Engr., vol. 53, no. 4, July 26, 1927, pp. 171-174, 4 figs. General description of various types of foundation for buildings and other structures.

METHODS. Construction Methods Used on Cleveland Terminal, F. W. Skinner. Eng. & Contracting, vol. 66, no. 7, July 1927, pp. 297-300, 9 figs. Open excavation carried to unprecedented depths and completed on scheduled time in spite of extreme difficulties; 17,000-ton steel framework roof, walls, floors and contents of 30 x 260 ft.; Union Terminal building, facing three sides of Public Square in Cleveland, are supported on 87 circular piers from about 4 ft. to 10½ ft. in diameter that are carried down in wells to depths varying from about 170 to 260 ft. below original surface of ground.

BUSBARS

PROTECTION. Bus Protection in Generating Stations. Power Plant Eng., vol. 31, no. 16, Aug. 15, 1927, pp. 885-886, 2 figs. Causes of bus failure; electrical, differential and faulty bus protection; phase balancing scheme.

C

CABLEWAYS

1,400-FT. SPAN. New Cableways of Asbestos Corporation, Ltd., H. V. Haight. Can. Min. Jl., vol. 48, no. 31, Aug. 5, 1927, pp. 618-621 11 figs. Description, with principal dimensions, of cableway and equipment.

CAMS

FACE, GENERATING. Generating Face Cams, E. A. Limming. Machy. (London), vol. 30, no. 773, Aug. 4. 1927, pp. 549-551, 4 figs. Operation involves generating process by milling cutter whose effective form and position are counterparts of those of roller.

CAR DUMPERS

CEMENT WORKS. Rolling-Type Car Dumper Handles Cars of 80 Tons' Capacity. Iron Trade Rev., vol. 81, no. 7, Aug. 18, 1927 pp. 384-385, 2 figs. Unique features of car dumper designed by Wellman-Seaver-Morgan Co. for plant of Florida Portland Cement Co., Tampa, Fla.

CAR WHEELS

HEAT TREATMENT. Heat Treatment Eliminates Wheel Failures. Elec. Ry. Jl., vol. 70, no. 3, July 16. 1927, pp. 93-94, 4 figs. Process of hardening and tempering rolled-steel car wheels has been developed by Twin City Rapid Transit Company; wear is reduced and so far no failures have occurred.

CARS

DESIGN. Passenger and Freight Car Design, V. Willoughby. Ry. & Locomotive Eng., vol. 40, no. 7, July 1927, pp. 197-198. Refrigeration box and container cars; passenger coaches too heavy.

CARS, FREIGHT

DUMP. Automatic Two-Way Side Hinged Dump Car. Ry. Age vol. 83, no. 7, Aug. 13, 1927, pp. 303-304, 2 figs. Design permits use in either dump or regular revenue service; capacity of 30 cu. yd.

MANAGEMENT AND DESIGN. Balancing Factors in the Use and Obligations Covering Ownership of Freight Train Cars, L. K. Sillcox. Mech. Eng., vol. 49, no. 8, Aug. 1927, pp. 857-864 and (discussion) 864-870, 17 figs. Discusses development of railroad equipment to date and points out principles to be observed if railroads would continue to expand and become more efficient transportation agents; importance of standardization is emphasized.

CARS, PASSENGER

PULLMAN SUPPLY OPERATIONS. Pullman Supply Operations Widely Scattered. Ry. Age, vol. 83, no. 4, July 23, 1927, pp. 133-135, 5 figs. Stores and laundries extend from Coast to Coast to serve cars and passengers; turnover is rapid.

CASE HARDENING

NITRATION HARDENING. Nitration Hardening of Steel and Its Industrial Utilization (La nitruration des aciers et son utilisation industrielle), L. Guillet. Génie Civil, vol. 91 no. 2, July 9, 1927, pp. 38-43, 18 figs. Review of Fry's work and of investigations made by author; discusses industrial importance of this new remarkably simple case-hardening process.

CAST IRON

NICKEL AND CHROMIUM IN. On the Effect of Nickel and Chromium on the Strength Properties of Grey Cast Iron, E. Piwowarsky. Foundry Trade Jl., vol. 36, nos. 568 and 569, July 7 and 14, 1927, pp. 4-6 and 37-41, 8 figs. Results of author's investigations. By causing cast iron having grey to mottled charge to solidify at first white to mottled by accelerated cooling, and graphitizing it only by subsequent annealing, mechanical strengths of range hitherto unreached were obtained.

CASTING

Continuous. Continuous Casting of Small Parts. Iron Age, vol. 120, no. 7, Aug. 18, 1927, pp. 391-393, 5 figs. Production of nearly 10,000 castings for small electrical motors attained with minimum of labour, reusing sand each hour.

Cylindrical Retort. Making a Cast-Iron Retort, J. Edgar. Mech. World, vol. 82, no. 21.3, July 1, 1927, pp. 3-4, 5 figs. Failing swept-loam pattern, either of two other methods may be adopted both of which involve thicknessing; best of these methods consists in sweeping mould direct, to which thickness of loam can be applied corresponding to thickness of metal required, forming core box in which core can be readily made.

CEMENT MILLS

Waste Heat Installations. Economy of Waste Heat Installations in the Cement Industry, O. Schott. Rock Products, vol. 30, no. 15, July 23, 1927, pp. 66-67. Gives data for three different plants operating rotary kilns.

CENTRAL STATIONS

Hell Gate, New York Cityy. Civil Engineering Features of the Hell Gate Station, E. M. van Norden and G. A. Hughes. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 3, Mar. 1927, pp. 337-365, 21 figs. Describes more important civil engineering features of station, introducing only such mechanical and electrical details as may be required to make complete picture. Discussion, Am. Soc. Civ. Engrs.—Proc., vol. 53 no. 6, Aug. 1927, pp. 1317-1318.

Diesel Engined. Reducing Transmission Losses by Diesel Engine Stations, S. A. Hadley. Power, vol. 66, no. 7, Aug. 16, 1927, pp. 244-246, 2 figs. Advantages of Diesel plants for transmission lines; reduction of line losses and increase in carrying capacity; actual plants now in operation.

Gas and Oil Engined. Combined Gas and Oil Engine Generating Station. Gas & Oil Power, vol. 22, no. 262, July 7, 1927, pp. 205-206, 2 figs. Account of activities of Bideford and District Electric Supply Co.; oil engine supplied by Premier Gas Engine Co. is of airless-injection type and capable of starting from cold state instantly; Crossley-Premier horizontal engine is provided with system of copious lubrication which is visible, positive, reliable and economical.

Heat Rates. Heat Rates for Steam Power Stations Compared, P. H. Hardie. Power, vol. 66, no. 5 Aug. 2, 1927, pp. 172-174, 5 figs. Definite conception of thermal economy to be expected from well-equipped stations with diverse equipment and designed for pressures from 200 to 1,200 lb. is obtainable from curves accompanying article.

Oil Burning. Inglis Station to Supply West Florida Territory, J. E. Shoudy. Power, vol. 66, no. 6, Aug. 9, 1927, pp. 196-199, 6 figs. Description of a 25,000-kw. oil burning plant, consisting of six 9,360 sq. ft. boilers, 325-lb. pressure steam with 200 deg. superheat; two 12,500-kw., 17-stage turbo-generators bled at 2 points for 2 low-pressure heaters.

Oil Engined. Are Spare Units Needed in Oil Engine Plants? E. J. Kates. Power, vol. 66 no. 5, Aug. 2, 1927, pp. 175-177, 4 figs. Author claims users are penalizing themselves by installing stand-by units, claims engines are as reliable as purchased energy and cites records to prove his point.

CHLORINE

Liquid, Containers for. Ton Liquefied Chlorine Gas Container, R. T. Baldwin. Can. Engr., vol. 53, no. 1, July 5, 1927, pp. 113-114. Chlorine-gas shipping problems and introduction of one-ton container. Paper presented at Am. Water Works Assn.

CIRCUIT BREAKERS

Air. Air Circuit Breakers Rupture Enormous Alternating Currents, W. M. Scott. Elec. World, vol. 90, no. 3, July 16, 1927, pp. 109-111, 6 figs. Tests made on air breakers by Commonwealth Edison Co., Chicago, reach magnitude of 99,000 amperes at 440 volts alternating current.

Developments. Circuit Breaker Development, R. M. Spurck. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 7, July 1927, pp. 707-711, 4 figs. Tells of (1) conditions which govern design of breaker of given interrupting capacity, (2) standardization that has been accomplished in rating breakers, and (3) trends in design of breakers constructed to meet operating requirements.

Oil. Tests on High- and Low-Voltage Oil Circuit Breakers, P. Sporn and H. P. St. Clair. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 7, July 1927, pp. 698-707, 34 figs. Data from large number of tests on several types of oil circuit breakers.

CITY PLANNING

Control. Provincial Town Planning Organization, T. D. Lemay. Can. Engr., vol. 53, no. 6 Aug. 9, 1927, pp. 211-212. Three phases of desirable governmental interest in town planning; propagation; supervision and compulsion.

COAL

Cleaning. Iron a Troublemaker in the Power Plant, Emerson Goble. Power House, vol. 21, no. 14, July 20, 1927, pp. 25-26, 30, 4 figs. Investigation of magnetic separators; types available, their uses, such as removal of tramp iron or steel from coal prior to its being crushed or pulverized in power plant.

Low-Temperature Treatment. Coal Processing, Its Future at Low Temperatures, H. C. Porter. Coal Age, vol. 32, no. 1, July 1927 pp. 39-41, 3 figs. Low-temperature treatment of coal produces smokeless fuel having many advantages not found in other solid fuels; greater yield of coke or char, more valuable oils, richer gas, satisfactory utilization of lignites and of poorer grades of coal.

Precarbonization for Power Plants. Precarbonization of Power Plant Coal, R. M. Crawford. Combustion, vol. 17, no. 2, Aug. 1927, pp. 94-97. Brief review of developments in this line; reasons for choosing low-temperature carbonization.

Preparation. Trent Process Used in Rhode Island, R. Peterson. Modern Min., vol. 4, no. 6, June 1927, pp. 162-165, 4 figs. Process by which raw dirty Rhode Island coal is transformed into burnable superfuel.

Pulverized. *See Pulverized Coal.*

COAL GAS

Industrial Fuel. Manufactured City Gas As An Industrial Fuel G. L. Montgomery. Chem. & Met. Eng., vol. 34, no. 7, July 1927, pp. 404-407, 9 figs. Successful applications of manufactured city gas as an industrial fuel in many varying industries.

COAL HANDLING

Conveyors. Coal-Handling with Ball-Bearing Belt Conveyors at a Modern Generating Station. Iron & Coal Trades Rev., vol. 115, no. 3096, July 1, 1927, p. 1, 3 figs.

COAL INDUSTRY

Railroad Fuel and. Railroad Fuel and Its Relation to Coal Mine Management, M. Macfarlane. Coal Age, vol. 32, no. 1, July 1927, pp. 19-22, 3 figs. New York Central lines offer excellent example of extent to which railroads have gone to protect their enormous coal supplies; New York Central buys its coal from several hundred mines located in seven states and all purchases are made upon recommendation as to quality of Fuel Inspection Department or directly under its supervision.

COAL MINES

Drainage. Coal Mine Drainage, H. N. Eavenson. Modern Min., vol. 4, no. 7, July 1927, pp. 202-206. Relation of coal mine drainage on streams.

Mechanization. Reports on the Mechanization Survey, G. B. Southward. Min. Congress Jl., vol. 13, no. 7, July 1927, pp. 541-545, 4 figs. Four mechanical-loading operations in room and pillar mining; different track and haulage arrangements; various types of mining equipment used.

Ventilation. Handling Gases Through Proper Ventilation, D. Harrington. Min. Congress Jl., vol. 13, no. 7, July 1927, pp. 531-532. Asphyxiation prime danger; mechanical ventilation recommended for all mines; 35 rules for safety in ventilation; basic problem is to prevent methane accumulation augmented by uniform safety practice.

Handling Gases Through Proper Ventilation, R. McAllister. Min. Congress Jl. vol. 13, no. 7, July 1927, pp. 533-534, 1 fig. Evolution of ventilation, all electrical installations confined to intakes; exhaust steam from fan discharged into intakes; two inspections of working places per shift by fire bosses; only officials and repair men permitted into return airways.

COAL MINING

Economics. Economics of Coal Mining, N. F. Hopkins. Engrs'. Soc. of West Pa.—Proc., vol. 43, no. 2, Mar. 1927, pp. 132-141 and (discussion) 141-147. It would seem as if mine which can be operated mechanically, in which overhead is not too great and management is efficient, will be one to survive next few years.

Nova Scotia. Economics of Coal Mining. Can. Min. Jl., vol. 48, no. 28, July 15, 1927, pp. 561-562. With special reference to conditions in Nova Scotia.

COBALT

Canada. Cobalt in Canada. Metal Industry (Lond.), vol. 31, no. 1, July 8, 1927, pp. 8-9. Occurrence; source; cobalt district; uses and market.

CONCRETE

Calcium Chloride in. Adding Calcium Chloride to Concrete Mix, L. D. Barrows. Contract Rec., vol. 41, no. 8, Feb. 23 1927, pp. 177-178, 2 figs. Method which permits solution to be accurately discharged into mixer drum at same time as water without need of any special attention. See also Roads & Streets, vol. 67, no. 2, Feb. 1927, pp. 66-67, 2 figs.; and Concrete, vol. 30, no. 4. Apr. 1927, pp. 39-40, 2 figs.; and Highway Engr. & Contractor, vol. 15, no. 1, Jan. 1927 pp. 90-91 2 figs.

Field Testing. The Field Testing of Concrete, R. B. Young. Eng. & Contracting, vol. 66, no. 7, July 1927, pp. 291-296, 4 figs. Methods and interpretation of results discussed in paper presented at 30th annual meeting of Am. Soc. of Testing Materials.

Mixtures. The Design of a Water-Cement-Ratio Concrete Mixture, R. P. V. Marquardsen. Roads & Streets, vol. 67, no. 7, July 1927, pp. 304-308, 2 figs. Writer points out what, in his opinion, constitutes shortcomings of fineness modulus method of designing concrete mixtures, and proposes new method for designing water-cement-ratio concrete mixtures which he believes will prove more certain of desired results and more practical in application.

CONCRETE CONSTRUCTION

Achievements. Recent Achievements with Concrete, J. Brett. Contract Rec., vol. 41, no. 27, July 6, 1927, pp. 670-674. Developments in use of Portland cement for construction purposes; new knowledge concerning action of concrete is leading to better building practice; answer to Prof. Swain's indictment in paper read at Am. Inst. Steel Construction.

Cold Weather Methods. Cold Weather Concrete Methods, F. H. McGraw. Eng. & Contracting, vol. 66, no. 7, July 1927, pp. 305-306. Measures for protecting concrete against injury due to low temperature outlined in paper presented Jan. 22 at annual meeting of Am. Soc. for Testing Materials.

Portland Cement Concrete. Building with Portland Cement Concrete, J. F. Brett. Can. Engr., vol. 53, no. 2, July 12, 1927, pp. 129-134, 6 figs. Recent achievements in structural engineering made possible by use of concrete; properties, handling and design of concrete; considers flexual hinge on Vesubi river bridge.

CONDENSERS, ELECTRIC

Synchronous. The World's Largest Synchronous Condensers, L. W. Riggs. Gen. Elec. Rev., vol. 30, no. 7, July 1927, pp. 335-338, 8 figs. Regulate voltage on 220,000-volt circuits; fabricated steel construction employed in both stator and rotor; latest advances in electrical and mechanical design incorporated.

CONSTRUCTION WORK

Steel Fabrication. Analysis Problems of Steel Fabricator, E. St. E. Lewis. Can. Machy. & Mfg. News, vol. 38, no. 5 Aug. 4, 1927, pp. 23-25 and 43-46. In which the author concludes the steel fabricator, as merchant must start with his raw product, with all his buyers in mind, and merchandise that product with these dictating his actions and decisions. Abstract of an address before the Am. Inst. of Steel Construction.

CONVEYORS

Aerial Ropeways. Transportation by Aerial Ropeways. So. African Min. & Eng. Jl., vol. 38, no. 1866, July 2, 1927, pp. 519-520. Advantages for "outside" mines in South Africa; special application to Barberton asbestos fields; lessons from other hilly countries.

Pneumatic. Pneumatic Coal Conveying Plant at the Sittingbourne Paper Mills. Indus. Mgmt. (Lond.), vol. 14, no. 8, Aug. 1927, pp. 283-285, 6 figs.

COPPER ALLOYS

Age-Hardening. Copper Alloys Capable of Age-Hardening. Metallurgist (Supp. to Engineer), July 1927, pp. 109-110, 2 figs. Chemical and mechanical properties of the alloys and the heat treatment.

COPPER METALLURGY

Leaching. Detailed Costs of Constructing and Equipping the Inspiration Copper-Leaching Plant G. G. Booth. Eng. & Min. Jl., vol. 124, no. 2, July 9, 1927, pp. 84-86, 3 figs. Overhead which was 4 per cent, excluding engineering, which was 4.4 per cent, leaving 91.6 per cent of total expenditure entering directly into construction of plant.

COPPER MINES

Utah. The New Utah Copper Townsite at Copperton, Utah, H. E. Munn. Min. Congress Jl., vol. 13, no. 7 July 1927, pp. 556-558, 4 figs. Company spent more than half million dollars in unsuccessful attempt to develop satisfactory living conditions for its employees in Canyon; now they have built an entirely new camp just outside Canyon.

CORES

Making. Stepping Up Production Mechanically, P. Dwyer. Foundry, vol. 55, no. 14, July 15, 1927, pp. 550-554, 9 figs. Methods and equipment employed at one of Buffalo plants of American Radiator Co.; mixing core sand; venting cores; oil-fired ovens.

COST ACCOUNTING

MACHINE-HOUR RATE. Cost Accounting Practice with Special Reference to Machine Hour Rate, C. H. Scovell. Paper Trade Jl., vol. 85, no. 6, Aug. 11, 1927, pp. 57-62, 1 fig. What constitutes adequate cost practice; why scientific rates are important.

METHODS AND PROBLEMS. The Construction, Use and Abuse of Cost Accounts, A. L. Dickinson. Jl. of Accountancy, vol. 44, no. 1, July 1927, pp. 1-20. Sketch of costing methods and of some of difficulties and problems involved therein.

STANDARD COSTS. Application of Standard Costs. Iron Age, vol. 120, no. 4, July 28, 1927, pp. 195-197, 1 fig. Practical example of use of standard burden for each department; instances of specific savings.

CRANES

A.C. AND D.C. MOTORS FOR. A.C. and D.C. Motors for Crane Operation, R. F. Emerson. Indus. Engr., vol. 85, no. 7, July 1927, pp. 315-316, 2 figs. Comparing advantages of one type of motor with other, it is possible to obtain much finer speed control with d.c. series motor than with an a.c. motor.

ELECTRIC. Cranes for Use in Ports and Harbours. So. African Eng., vol. 38, no. 7, July 1927, pp. 140-142, 2 figs. Comparison of working speeds in electric cranes; methods of supplying current; cables may be laid in three ways.

GANTRY. Electric Travelling Gantry Crane of 480 Tons of Naval Artillery Ordinance at Havre, France (Grue roulante électrique à portique, de 480 tonnes, du polygone de l'Artillerie Navale, à Havre, près de Lorient), C. Dantin. Génie Civil, vol. 90, no. 24, June 11, 1927, pp. 569-572, 5 figs. Crane and electric travelling platform built by Establishment Dayde for French Marine, intended for lifting heavy pieces on board warships.

GIRDERS. The Selection of Rolled Steel Joists and Compounds for Crane Girders, E. G. Fiegehen. Mech. Wld. vol. 82, no. 2116, July 22, 1927, pp. 57-58, 4 figs. Qualifications of a satisfactory crane girder are adequate strength, adequate stiffness, lateral-rigidity, economical weight (purchase and shipping).

SPEED-LIMITING BRAKES. Centrifugal Speed-Limiting Brake, J. P. Hall. Mech. World, vol. 82, no. 2113, July 1, 1927, pp. 9-10, 4 figs. Centrifugal over-speed brake which is claimed to be very effective in action.

CRANKCASES

MACHINING. Crankcase Work at the Curtiss Plant, F. H. Colvin. Am. Mach., vol. 67, no. 5, Aug. 4, 1927, pp. 187-190, 9 figs. Methods, fixtures and tools used in machining crankcase of Curtiss 400-h.p. D-12 engine; studs for holding cylinder water jackets set before final boring.

CRUSHERS

GYRATORY. The Gyratory as a Sledging Crusher, W. T. W. Miller. Eng. & Min. Jl., vol. 124, no. 1, July 2, 1927, pp. 7-11, 9 figs. Outstanding advantage of gyratory crusher over jaw machine as sledger is fact that it is capable of giving much larger output, so that, where material to be crushed is not exceptionally hard, and when large tonnages have to be dealt with, gyratory should be chosen for the work.

CUPOLAS

COKE, INFLUENCE OF. The Properties of Coke Affecting the Cupola Melting of Steel, J. T. MacKenzie. Foundry Trade Jl., vol. 36, no. 568, July 7, 1927, pp. 15-18, 1 fig. Deals chiefly with total carbon absorbed by steel scrap when melted with various cokes of unusual collection, not complete, but well representative and containing extremes likely to be encountered.

CONTINUOUS MELTING WITH. Continuous Melting with the Cupola, W. J. May. Mech. World, vol. 82, no. 2115, July 15, 1927, pp. 39-40, 2 figs. Describes cupolas suitable for general work, pointing out special feature necessary for continuous melting.

D

DAMS

GRAVITY, ARCHED. Notes on Arched Gravity Dams, B. F. Jakobsen. Am. Soc. of Civil Engrs.—Proc., vol. 53, no. 6, Aug. 1927, pp. 1135-1142, 2 figs. Formulas are developed for gravity dam having triangular section and vertical upstream face that is curved in plan to radius *Ru;* it is shown that radius of curvature influences stresses considerably and that it is never safe to neglect curvature as has been customary in past.

TYPES. Types of Storage Dams and Their Particular Adaptation to Western Conditions, F. A. Noetzli. Modern Irrigation vol. 3, no. 6, June 1927, pp. 18-21 and 90, 8 figs. Round-head buttress type, latest development in dam construction, will cost 30 to 35 per cent less than ordinary gravity dams.

DIES

BLANKING, PIERCING AND FORMING. Blanking, Piercing and Forming Dies, F. A. Stanley. West. Machy. World, vol. 18, no. 6, June 1927, pp. 261-264, 11 figs. Complete set for producing Ford oiler for filtering crankcase oil; these tools receive sheared blank and carry it through various forming, trimming and piercing operations and also blank and pierce filter plates or strainers for interior of device.

DIE-SINKING AND ENGRAVING MACHINE. Gorton No. 3-X Universal Die-Sinking and Engraving Machine. Am. Mach., vol. 67, no. 5, Aug. 4, 1927, p. 211. Suited to either heavy or light engraving and die sinking on flat or spherical surfaces.

PUNCH-PRESS. Dies for Producing Laminations P. J. Edmonds. Machy. (Lond.), vol. 30, no. 772, July 28, 1927, pp. 513-517, 6 figs. First of two articles dealing with design, construction and application of dies for manufacturing laminations used in electrical apparatus.

DIESEL ENGINES

AIRLESS-INJECTION. Solid Injection Diesel Engine for Dynamo Drive. Soc. Mech. Engrs.—Jl., vol. 30, no. 122, June 1927, pp. 295-3'8. In case of solid-injection system, only thing to be done is to control fuel-oil quantity; author used mechanically operated fuel valve and controlled pressure positively by mechanical means; according to his design, angle of fuel valve opening as well as fuel pump are controlled automatically by governor.

AUTOMOTIVE PURPOSES. Diesel Engine Progress. Autocar, vol. 59, no. 1654, July 15, 1927, pp. 122-123, 4 figs. Widespread experiments, many of which promise well, are bringing oil-fuel engine nearer and nearer for automobile use. Describes new engine, known as Acro air-storage engine, operating on Diesel principles and giving satisfactory tests.

EXHAUST TURBO CHARGING. Exhaust Turbo Charging for Diesels. Gas & Oil Power, vol. 22, no. 262, July 7, 1927, pp. 217-218, 3 figs. New type of heavy-oil engine for medium and large outputs, which is said to offer many advantages over Diesel engines as hitherto constructed.

MOTOR TRUCK. M.A.N. Diesel Lorry Engines, W. F. Bradley. Motor Transport, vol. 45, no. 1165, July 11, 1927 pp. 49-50, 5 figs. Main features of 4- and 6-cylinder units; economical results obtained under service conditions.

E

ELECTRIC DRIVE

SMALL BENCH MACHINES. The Application of Electric Motors to Small Bench Machines. Machy. (Lond.), vol. 30, no. 771, July 21, 1927, pp. 481-486, 12 figs. Applications to a riveting machine, a lapping machine, semi-automatic facing lathe, a boring and reaming machine and a spinning machine.

TYPES. Several Types of Electric Drives Compared, R. H. Rogers. Blast Furnace & Steel Plant, vol. 15, no. 7, July 1927, pp. 344-346. Electricity is rapidly replacing other methods of generating power and thus instituting economics together with increased production; steel mills among greatest users.

ELECTRIC FURNACES

AUXILIARY EQUIPMENT. Auxiliary Equipment for Electric Melting Furnaces, J. D. Keller. Fuels & Furnaces vol. 5, no. 8, Aug. 1927, pp. 1011-1017, 14 figs. Discussion on apparatus employed for controlling arc furnaces and induction furnaces; electrical connections; electrode regulators; power imitators, reactors; transformers; generators.

CAST IRON. Grey Cast Iron from the Point of View of the Electrical Furnace, G. K. Elliott. West. Machy. World, vol. 18, no. 6, June 1927, pp. 279-281. Outlines main features of acid and basic electric furnaces, and effects of each upon principal elements of cast iron in comparison with effects obtained through cupola.

HEAT-TREATMENT. Electric Furnaces of Interesting Design Used in Heat Treatment of Gears, I. S. Wishoski. Fuels & Furnaces, vol. 5, no. 8, Aug. 1927, pp. 991-995, 3 figs. Electrically heated furnace of roller hearth type with heating elements above and below hearth, used in heat treating gears and pinions for automobile differentials; automatic electric furnace with vertical heating chamber used in heat treating ring gears.

LINING. Plastic Furnace Lining Gives Long Service. Power Plant Eng., vol. 31, no. 16, Aug. 15, 1927 pp. 870-872, 12 figs. Properly installed so that it is thoroughly pressed into uniform mass and properly vitrified it will last long periods under most severe firing.

ELECTRIC GENERATORS, A.C.

EXCITATION. High-Speed Excitation for Generators, F. G. Hammer. Elec. Wld., vol. 90, no. 6, Aug. 6, 1927, pp. 261-263, 4 figs. Factors taken into consideration in adoption of high-speed excitation system for lock 18 hydro-electric plant of Alabama Power Co.

REACTION-TYPE. A 10-Kw., 20,000-Cycle Alternator, M. C. Spender. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 7, July 1927, pp. 681-687, 10 figs. Discusses advantages and limitations of inductor and reaction types of alternators when designed for generating a.c. of very high frequency; new design for reaction-type alternator is described in which some of limitations of usual type of reaction alternator have been overcome in way which enables such alternators to be designed for higher frequency and greater output; complete specification of 10-kw. 20,000-cycle alternator of new type are given and its operating characteristics, as determined by test, shown by series of curves; method is developed by means of which various losses in alternator may be separated and complete operating characteristics of alternator under any condition of load predetermined from no-load tests.

ELECTRIC LOCOMOTIVES

COUPLING RODS. The Design of Coupling Rods for Electric Locomotives. Engineering, vol. 124, no. 3210, July 22, 1927, pp. 95-98, 11 figs. Position of jack shaft; typical examples of arrangement of rods; automatic limitations of axial stress; reaction to tractive effort.

GREAT NORTHERN RY. Great Northern Electric Locomotives, E. R. Martin. Ry. & Locomotive Eng., vol. 40, no. 7, July 1927, pp. 191-192, 2 figs. General description of rotating apparatus and operating features.

ELECTRIC MEASURING INSTRUMENTS

ALTERNATING-CURRENT. Some Recent Advances in Alternating-Current Measuring Instruments, K. Edgcumbe and F. E. J. Ockenden. Instn. Elec. Engrs., vol. 65, no. 336, June 1927, pp. 553-586 and (discussion) 586-599, 14 figs. Moving-iron instrument is investigated, from what is thought to be new standpoint, and form of precision moving-iron ammeter and voltmeter, with electrical accuracy of about 0.1 per cent and suitable for use indiscriminately with alternating and direct current is described; use of series condensers for extension of range of electrostatic voltmeters for extra-high voltage measurements; use and limitations of thermo-expansion ammeters for radio-frequency current measurements; recent developments in field of graphic instruments; capacity of meters, shunts, current transformers, etc., to withstand heavy short-circuit currents.

ELECTRIC METERS

FREQUENCY. How Frequency Meters Operate, E. H. Stivender. Power, vol. 66, no. 5, Aug. 2, 1927, pp. 164-167, 7 figs. Classification is made on basis of operating principle, and typical instruments of each of four types are described; both indicating and graphic-recording meters are taken up.

ELECTRIC MOTORS

INSULATION. The Care of Motor Insulation, C. W. Falls. Gen. Elec. Rev. vol. 30, no. 8, Aug. 1927, pp. 396-398. Relation of lubrication to insulation; proper storage conditions; several methods of drying out available; importance of resistance tests; frequent inspection of insulation necessary; care should be used in cleaning; treatment after cleaning.

SQUIRREL CAGE. Improved Electric Motors. Engineer, vol. 144, no. 3732, July 22, 1927, pp. 100-101, 4 figs. Details of Maxtorq motors which are squirrel cage motors with special rotors capable of developing good starting torque.

ELECTRIC MOTORS, A.C.

STARTING. Full-Voltage Starting of Large A.C. Motors, J. W. Anderson and A. C. Monteith. Power, vol. 66, no. 3, July 19, 1927, pp. 110-111, 4 figs. Tests were made at Richmond station of Philadelphia Electric Co. to determine effects of starting 500-h.p. 2,200-volt squirrel-cage motors on circulating-water pumps by connecting them directly across line.

ELECTRIC MOTORS, D.C.

CHANGE OF OPERATING SPEED. How to Operate D.C. Motors, C. B. Hathaway. Power, vol. 65, no. 7, Aug. 16, 1927, pp. 240-243. Details of changes necessary to operate direct-current electric motors other than the speeds on the nameplate.

ELECTRIC RAILWAYS

CONTACT SYSTEM. Contact System Mounted on Springs, F. R. Thompson. Ry. Age, vol. 83, no. 7, Aug. 13, 1927, pp. 297-300, 5 figs. Electrified Lackawanna yard has overhead systems installed on soft ground and designed to compensate for ice loading.

ELECTRIC TRANSMISSION LINES

PROGRESS. Transmission and Distribution. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 7, July 1927, pp. 691-697. Annual report of Committee on Power Transmission and Distribution.

ELECTRIC WELDING ARC

ABSORPTION PLANT APPARATUS. Importance of Welding as Applied to Absorption Plant Apparatus, J. E. Kobernick. Nat. Petroleum News, vol. 19, no. 26, June 29, 1927, pp. 23-25. Tests by General Electric and Westinghouse companies have been made covering almost every phase of arc welding and records show welding to withstand fatigue that riveted joints can never endure.

ROLLED STEEL. Rolled Steel Fabricated by Welding Displaces Castings in Machine Construction, R. H. Rogers. General Elec. Rev., vol. 30, no. 7, July 1927, pp. 330-334, 11 figs. Rolled steel is stronger pound for pound; readily fabricated by metallic arc welding; greater freedom in machine design; quicker production; final product superior.

STRUCTURAL STEEL. Arc Welding a 790-Ton Steel Structure, A. M. Candy. Elec. World, vol. 90, no. 4, July 23, 1927, pp. 157-162 8 figs. One-quarter million cu. ft. building at Sharon, Pa., field welded at $4.90 per ton, or 45 cents per weld-foot, and erected in five weeks; factors affecting training of welders; methods used; analysis of data.

ELECTRICAL MACHINERY

INSULATION. What Do You Know About the Insulation of Your Electrical Machines? C. L. Keene. Power, vol. 66, no. 3, July 19, 1927, pp. 82-85, 7 figs. Author shows how dirt, moisture, temperature and voltage affect quality of insulation and tells how tests are made to determine condition of electrical-machine insulation.

ELEVATORS

OFFICE BUILDING. Elevator Service Requirements of the Modern Office Building, B. Jones. Gen. Elec. Rev. vol. 30, no. 8, Aug. 1927, pp. 375-386, 13 figs. Building location and types of occupancy as factors in determining elevator service; effects of business habits of building occupants; determination of traffic factors; specific data on population densities; fixing of schedule; present demands and tendencies.

ENGINEERING

THEORY AND PRACTICE. Theory and Practice in Engineering, W. E. W. Millington. Indus. Mgmt. (Lond.), vol. 14, no. 8, Aug. 1927, pp. 291-293. Abstracts from Presidential Address delivered by author at the Northwestern Section of the Junior Institution of Engineers.

ENGINEERS

SERVICES AND SALARIES. Services and Salaries of Engineers, A. Richards. Professional Engr., vol. 12, nos. 1, 2 and 4, Jan., Feb. and Apr. 1927, pp. 16-23, 22-24 and 22-25, 13 figs. Data on average annual compensation for New York City employees; Massachusetts Civil Service salary classification; analysis of salaries of county engineers in Ohio; outstanding practice problems of profession; negotiations for professional engagements; unprofessional competition; legality of rules against competition. Feb.: Question as to who are professional engineers. Apr.: Salaries of civil engineers.

F

FATIGUE

ELIMINATION OF. Reduction of Waste of Human Lives by the Elimination of Unnecessary Fatigue in Industry, E. R. Hayhurst. Soc. Indus. Engrs.—Bul., vol. 9, no. 3, Mar. 1927 pp. 22-24. Paper read at annual meeting of S.I.E. Fatigue Committee at Philadelphia Convention, June 17, 1926; adapted from author's monograph on "Occupation and Diseases of Middle Life" in "Diseases of Middle Life," edited by F. A. Craig, vol. 1, pp. 83-174, F. A. Davis Co., 1923.

FLOODS

FLOWS. Probability of Flood Flows, F. G. Switzer. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 4, Apr. 1927, pp. 563-569, 4 figs. Frequency curves may be applied to flood data in determining flood-flow probabilities; results are shown, also relation between floods and drainage areas, for floods of equal probability. Discussion, Am. Soc. of Civil Engrs.—Proc. vol. 53, no. 6, Aug. 1927, pp. 1257-1268.

FLOTATION

SELECTION. Selective Flotation at Chief Consolidated, H. L. Johnson. Colo. School of Mines—Mag., vol. 17, no. 2, June 1927, pp. 9-13, 2 figs. Changing character of ore makes difficult mill task, but flotation solves problem.

FOUNDATIONS

PRESSURES UNDER RECTANGULAR BASES. Foundation Pressures Under Rectangular Bases Eccentrically Loaded, R. P. V. Marquardsen. Eng. & Contracting, vol. 66, no. 6, June 1927, pp. 262-266, 14 figs. Formulas and diagrams for solution of special problems involving foundation pressures under rectangular bases eccentrically loaded.

FLOW OF FLUIDS

JETS DEFLECTED BY WALL SURFACES. Plane Jets Deflected by Wall Surfaces. Soc. of Mech. Engrs.—Jl., vol. 30, no. 122, June 1927 pp. 257-294, 45 figs. Results of analytical and experimental investigations of jets of two dimensions deflected by various wall surfaces; deals also with jet guided and deflected by two very long straight walls making corner angle; author calculates angle of deviation, increase of breadth of jets at centre of deflection and pressure distribution along wall, which are important in design of turbine vanes; it is also made clear that if initial direction of jet is set tangentially to wall end, some part of flow will leak outwardly from wall tip. (In Japanese.)

FLUIDS

TWO-DIMENSIONAL LAYERS. Superficial Solutions of Two-Dimensional Fluid Layers (Les solutions superficielles ou les fluides à deux dimensions), A. Troller. Nature (Paris), no. 2761, May 15, 1927, pp. 443-448, 12 figs. Deals with peculiar method of spreading of certain materials, such as oleic acid, benzoate of benzyl, camphor, etc., over surface of water; facts brought out may possibly have bearing on certain phenomena occurring in boilers; such materials have ability of spreading upon surface of water in a layer which has ability to spread indefinitely in two dimensions. See translation in Mech. Eng., vol. 49 no. 9, Sept. 1927, pp —.

FORGE SHOPS

AUTOMOBILE PLANTS. Dodge Forge and Heat Treating Plant, C. Longenecker. Forging—Stamping—Heat Treating, vol. 13, nos. 5, 6 and 7, May, June and July 1927, pp. 174-177, 212-215 and 260-264, 12 figs. New plant of Dodge Brothers; routing of material; fuel supply and distribution. Exemplifies latest practice in design and equipment; efficient lighting and ventilation; furnaces and hammers located to facilitate movement of material. Heat treating, cleaning and pickling performed on large-scale production; "safety first" given adequate attention.

NON-FINANCIAL INCENTIVES IN. The Value of Non-Financial Incentives in the Forge Shop, J. Thompson. Forging—Stamping—Heat Treating, vol. 13, no. 6, June 1927, pp. 228-230. Discussion of inducements, other than wages, which affect a workman's attitude toward his work and result in increased interest and efficiency.

FORGING

FLOW OF METALS IN. The Flow of Metals in Forging. Forging—Stamping—Heat Treating vol. 13, no. 7, July 1927, pp. 248-252, 2 figs. To secure maximum strength and durability, parts should be so formed that "flow lines" are in correct position; methods of etching.

UPSET PROCESS. Forging by the Upset Process, J. C. Kiehnan. Forging—Stamping—Heat Treating, vol. 13, no. 6, June 1927, pp. 208-211. Forging rings by upset process; use of right steel for forging dies and proper heat treatment essential for long service.

FOUNDRIES

COMPRESSED AIR IN. Compressed Air Aids Foundry to Turn Out More and Finer Castings, R. G. Skerrett. Compressed Air Mag., vol. 32, no. 8, Aug. 1927, pp. 2101-2106, 18 figs.

STEEL, PHRASEOLOGY. Steel Foundry Phraseology. Research Group News, vol. 4, no. 2, July 15, 1927, pp. 137-140. Presents and defines terms with which users of steel castings may become acquainted to their advantage in desired better familiarity with shop practices, encouraged by progressive steel founders; terms relating to equipment, moulding, metal and defects.

FUELS

COAL. *See Coal.*

OIL FUEL. *See Oil Fuel.*

PULVERIZED COAL. *See Pulverized Coal.*

FURNACES, INDUSTRIAL

CHARGING MACHINES. Charging Machines for Industrial Furnaces. Engineering. vol. 124, no. 3211, July 29, 1927, pp. 136-137, 10 figs., partly on supp. plate. Machine employed in handling steel plates in heat-treating furnaces.

DESIGN. Practical Industrial Furnace Design, M. H. Mawhinney. Forging—Stamping—Heat Treating, vol. 13, no. 7, July 1927, pp. 271-275, 1 fig. Enumeration of several channels through which heat is lost; calculations for electric furnaces; rate of heating and methods for saving heat.

G

GAUGES

TEMPERATURE OF ADJUSTMENT. Temperature of Adjustment of Industrial Gauges (La température d'ajustage des calibres industriels), A. Pérard. Génie Civil vol. 90, no. 26, June 25, 1927, pp. 621-624, 3 figs. Plea to German Industrial Standards Committee to eradopt adjustment of 0 deg. instead of 20 deg. cent.; discusses requisite precision for industrial gauges and necessity for standardization of temperature of adjustment.

GARBAGE COLLECTION

VICTORIA, B.C. Garbage Collection at Victoria, B.C., F. M. Preston. Can. Engr., vol. 53, no. 3, July 19, 1927, pp. 141-142, 4 figs. No collection charge for private residences, but commercial houses pay 15 cents per can; collection made entirely by motor trucks; units costs for collection and quantities collected by each unit; garbage towed out to sea and dumped.

GAS WORKS

HEAT RECOVERY. Surplus Heat Utilization Possibilities in Canadian Coal Gas Plants, W. C. Philpott. Am. Gas Jl., vol. 127 no. 2, July 9, 1927, pp. 37-38. Reviews subject of heat losses occurring in coal carbonization, and describes what is being accomplished in heat recovery.

UTILIZING SURPLUS HEAT. Surplus Heat Utilization Possibilities in Canadian Gas Plants, W. C. Philpott. Gas Wld., vol. 87, no. 2242, July 23, 1927, pp. 82-83. Concise statement of what is being accomplished in way of conserving heat in gas works of three countries, England, Canada and United States.

GEARS

INSTRUMENTS FOR MEASURING NORMAL PITCH. Instrument for Measuring Normal Pitch, B. Wheeler. Automotive Industries, vol. 57, no. 6, Aug. 6, 1927, pp. 186-190, 17 figs. Instruments designed to gauge distance between corresponding involute contours on consecutive teeth measured along line perpendicular or normal contours.

MOULDED. Constant Improvement in Moulded Gears. Plastics vol. 5, no. 7, July 1927, pp. 325-326 and 344, 5 figs. Patented processes disclose short cuts in manufacturing methods that should further extend usefulness of silent fibrous gears.

GEOLOGY

YUKON. Whitehorse District, Yukon, W. E. Cockfield and A. H. Bell. Canada Dept. Mines, Geol. Survey—Memoir, no. 131, 1927, 61 pp. Topography, general and economic geology.

GOLD DEPOSITS

BRITISH COLUMBIA. Placer and Vein Gold Deposits of Barkerville, Cariboo District, British Columbia, W. A. Johnston and W. L. Uglow. Canada Dept. Mines, Geol. Survey—Memoir, no. 130, 1927, 246 pp. General and economic geology; origin of placer gold.

GOLD MINING

PLACER. Placer-Mining Methods and Costs in Alaska, N. L. Wimmler. U.S. Bur. Mines—Bul., no. 259, 1927, 224 pp., 68 figs. Results of study of present conditions in Alaska placer mining, including methods employed and costs.

GRINDING

CENTRELESS. Centreless Grinding Practice. Automobile Engr., vol. 36, no. 230 July 1927, pp. 264-266, 8 figs. Typical example of work in American factories.

FINISHING BY. Finishing by Grinding from a Foreign Viewpoint, J. Reindl. Abrasive Industry, vol. 8, no. 8, Aug. 1927, p. 259. Stresses importance of commercial grinding and draws attention to fact that it is in production of fine quality of surfaces that grinding process is of especial importance.

SLIDES AND WAYS. Grinding Ways and Slides, L. Sichel. Machy. (Lond.), vol. 30, no. 771, July 21, 1927, pp. 498-500, 5 figs. Machines used; method of setting up work; quality work.

GRINDING MACHINES

FACE. Face Grinder Supersedes Planer. Abrasive Industry, vol. 8, no. 8 Aug. 1927, pp. 251-252. Based on comparative study of results obtained from heavy-duty 36-inch face grinding machine and 36-inch planer made at plant of Link Belt Co., Chicago; cost reduction on five typical operations averaged 66 per cent when using grinding machine.

SURFACE. Direct Motor-Driven Vertical Surface Grinding Machines. Machy. (Lond.), vol. 30, no. 771, July 21, 1927, pp. 486-487, 4 figs. Description of a machine with T-slot table 4 ft. 6 in. by 18 in. and 3 rates of automatic traverse.

36-inch by 12-inch Surface Grinding Machine. Machy. (Lond.), vol. 30, no. 773, Aug. 4, 1927, p. 558, 2 figs. Description of 36- by 12-in. surface grinding machine made by John Holroyd & Co., Ltd., Milnrow, Rochdale.

H

HEATING

CALCULATIONS. "Responsivity" as a Factor in Heating Calculations, C. F. Wolfsfeld. Heating & Ventilating Mag., vol. 24, no. 8, Aug. 1927, pp. 55-61, 3 figs. New method of figuring based on rate of heat penetration through building materials.

HEATING, ELECTRIC

BOILERS. The Cogenga Electric Boiler (La chaudiere électrique Cogenga), M. Gacogne. Revue Générale de l'Electricité, vol. 22, no. 3, July 1927, pp. 115-120, 8 figs. Description of prize-winning French invention, consisting of electrodes immersed in small chamber filled with water, which is set in volume of water to be heated; vapour forming in small chamber acts as insulator and maintains pressure equilibrium; principle of this self-regulating device can be put to other uses, such as circuit breaking thermostat for temperatures above 100 deg. C., etc.

HEATING, HOT-AIR

HOUSES. Comparing Heating Costs with Inside-, Outside- and Combined-Air Supply, A. M. Daniels. Sheet Metal Worker, vol. 18, no. 11, 12 and 13, July 1, 15 and 29, 1927, pp. 410-412, 454-455 and 490-491, 3 figs. Calculations for a typical residence, with explanations of various operations, step by step, for all inside and all outside air.

HEATING, STEAM

CENTRAL. Purdue's New Central Heating Plant J. D. Hoffman. Heat. & Vent. Mag., vol. 24, nos. 7 and 8, July and Aug. 1927, pp. 69-71 and 79 and 64-68, 9 figs. Details of steam-heating and power-distributing system covering 1,000 acres with radition load of 700,000 sq. ft. Determining steam requirements and sizes of mains; costs of materials, equipment and installation.

HIGHWAYS

GRADE CROSSING PROBLEM. The Highway Grade Crossing Problem, R. H. Ford. West. Soc. Engrs.—Jl., vol. 32, no. 6, July 1927, pp. 195-204 and (discussion) 204-206. Highway grade crossing situation is one of most important problems confronting American public to-day, largely because of wide diversity of interests and political jurisdictions under which highway system is supervised and controlled.

SURFACING. Modern Crushed Stone and Gravel Surfacing, J. W. Hoover. Am. Soc. of Civil Engrs. Proc., vol. 53, no. 6, Aug. 1927 pp. 1185-1188 . Brief review of gravel or crushed-rock surfacing specifications for a roadway that is to be maintained by dragging loose material back and forth.

WIDENING VS. PARALLEL LINES. Widening Trunk Lines vs. Building Parallel Highways, B. H. Petty. Highway Engr. & Contractor, vol. 17, no. 1, July 1927, pp. 35-37. Arguments favoring wide pavements and arguments against widening; arguments for and against parallel routes; majority opinion of highway engineers and officials consulted by writer considers 40 ft. as being maximum desirable continuous width of pavement for heavily travelled highways; where this is not adequate for traffic, parallel routes (not necessarily within a mile or two of road involved) should be developed to handle excess.

HYDRAULIC ACCUMULATORS

GERMANY. Claims World's Largest Hydraulic Accumulator Works. Elec. World, vol. 90, no. 3, July 16, 1927, p. 111.

HYDRO-ELECTRIC PLANTS

ALOUETTE, CANADA. Largest Automatic Generating Unit, C. W. Colvin. Contract Rec. & Eng. Rev., vol. 41, no. 30 July 27, 1927, pp. 745-747, 4 figs. Special electrical features of single 10,000-kva. remote controlled machine installed at Alouette generating station of British Columbia Elec. Ry. Co.

CONSTRUCTION. Construction Methods for Power Plants. Contract Rec. & Eng. Rev., vol. 41, no. 29, July 20, 1927, pp. 719-721. Extensive nature of hydro-electric developments and usual necessity for rapidity of work require special equipment layout; how Hemmings Falls development was carried out.

JORDAN RIVER, CANADA. Jordan River Hydro Power Development. Can. Engr., vol. 53, no. 5, Aug. 2, 1927, pp. 179-181, 6 figs. Supplies power to Victoria and municipalities on Vancouver Island; Ambursen dam is 891 ft. long and 126 ft. maximum height; two Pelton-double wheels have capacity of 600 h.p. each and third unit of 13,000 h.p.; new flume construction.

NOVA SCOTIA. Sandy Lake Hydro Power Development, H. S. Johnston. Can. Engr., vol. 53 no. 2, July 12, 1927, pp. 119-120, 3 figs. Nova Scotia Power Commission has commenced work on new development as part of St. Margaret's Bay system; Mill Lake power station will be extended to take two 2,500-h.p. units; intake dam and wood-stave pipe line.

ONTARIO. New Campbellford Station Quinte and Trent Valley Power Co. Contract Rec. & Eng. Rev., vol. 41, no. 25, June 22, 1927, pp. 630-632, 4 figs. Will be utilized to generate steam for pulp and paper board mill controlled by allied interests.

New Hydro Plant in Almonte, W. H. Black. Elec. News, vol. 36, no. 14. July 15, 1927, pp. 29-30, 2 figs. New development is located at foot of second of cascades into which Mississippi River breaks in its flow through town; power house is connected by 100-ft. cement-lined canal with natural mill pond situated between first and second cascades.

PARALLEL OPERATION WITH STEAM. Operation of Hydro and Steam Plants in Parallel, F. A. Allner. Power, vol. 66, no. 4, July 26, 1927, pp. 135-138, 4 figs. Steam plant having two 10,000-kw. units is located at hydro station and is designed for operating conditions at hydro plant; hydro units, which are rated at 13,500 to 20,000 h.p., are commonly brought up to speed from standstill and synchronized with system in less than a minute without any preliminary preparations, and frequently time is less than one-half minute.

QUEBEC. Coaticook Hydro-Electric Power Plant, A. A. Young. Can. Engr., vol. 52, no. 26, June 28, 1927, pp. 624-627, 8 figs. Water is conveyed from pond through tunnel 1,550 feet long to power plant where two 1,000-h.p. turbines and generators are installed; tunnel was driven through rock and is lined with concrete; horseshoe section 7 ft. wide by 8 ft. high.

I

ICE

SHEARING STRENGTH. Tests on the Shearing Strength of Ice, J. N. Finlayson. Can. Engr., vol. 53, no. 1, July 5, 1927, pp. 101-103, 4 figs. Results of experiments conducted at University of Manitoba to obtain data on strength of ice in shear; average value of shearing strength ranges from 98 to 114 lb. per sq. in.; variations between river and artificial ice.

ICE MANUFACTURE

CRACKING. Forcing Production in Ice Plants, C. H. Berter. Power Plant Eng., vol. 3¹, no. 16, Aug. 15, 1927, pp. 891-892. 1 fig. Cracked ice led to investigation of various factors involved in forcing refrigerating equipment to secure high capacity; unbalanced plant justified.

ICE PLANTS

DIESEL-ENGINED. Experiences with Diesel Engines in a California Ice Plant. Power, vol. 66, no. 7, Aug. 16, 1927, pp. 248-249 3 figs. Oil engines give a low cost per ton of ice; high atmospheric temperatures prompted cooling of engine air; noise is exhaust silenced.

INDICATORS

INTERNAL-COMBUSTION ENGINES. Indicator for High-Speed Internal Combustion Engines (Sur un monographe pour la mesure des pressions rapidement variables et un indicateur pour l'étude des machines thermiques à grande vitesse), M. Huguenard, A. Magnan and A. Planiol. Académie des Sciences—Comptes Rendus, vol. 184, no. 11, Mar. 14, 1927, pp. 667-671, 1 fig. See translated abstract in Science Abstracts (Sec. B), vol. 30, part 6, June 25, 1927, p. 291.

INDUSTRIAL MANAGEMENT

BUDGETARY CONTROL. Principles of Budgetary Control A. W. Torbet. Soc. of Indus. Engrs.—Bul., vol. 9, no. 2, Feb. 1927, pp. 7-10. Before The Society of Industrial Engineers, Chicago Chapter, Jan. 11, 1927.

Problems in Applied Budgeting, G. M. Pelton. Soc. of Indus. Engrs.—Bul., vol. 9, no. 2, Feb. 1927, pp. 11-16. An address delivered at meeting of S.I.E., Chicago Chapter, Feb. 10, 1927.

COST ACCOUNTING. *See Cost Accounting.*

ECONOMICS. The Economist as an Industrial Engineer, L. S. Lyon. Soc. Indus. Engrs.—Bul., vol. 9, no. 3 Mar. 1927, pp. 10-12 and 21. Similarity of work of economist and industrial engineer. Address delivered at S.I.E. 13th National Convention, Philadelphia, June 18, 1926.

FATIGUE. *See Fatigue.*

INVENTORIES. Tested Methods for an Accurate Inventory, T. H. Hicks. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 107-110, 7 figs. As applied in the United States Navy.

MEASUREMENT OF EFFECT OF FATIGUE. An 18% Reduction in Unit Labour Cost, W. C. Hasselhorn. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 133-135, 6 figs. Through measurement of effect of fatigue and improvement in working conditions.

OFFICE WORK. The Principles of Effective Management Applied to Office Work, F. L. Rowland. Soc. Indus. Engrs.—Bul. vol. 9, no. 7, July 1927, pp. 11-20. Problems in personnel, mechanical equipment and methods. Address delivered at S.I.E. 14th National Convention, Chicago, May 27, 1927.

POOLING OF IDEAS. How Pooling Ideas Can Reduce Costs, F. C. Shafer. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 125-128, 6 figs. Group meetings of standards, engineering, purchasing and manufacturing departments are recommended by Mr. Shafer as means to lower costs; on one part where this method was tried cost was reduced 27 per cent; on another cost was cut from $4.25 to $2.25.

PRODUCTION. Teaching Production Principles to Engineering Students, M. A. Lee. Soc. of Automotive Engrs.—Jl., vol. 21, no. 2, Aug. 1927, pp. 193-199, 4 figs. Outline of curriculum at Cornell University.

PRODUCTION CONTROL. Production Control for Lower Costs F. B. Calhoun. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 95-98, 4 figs. Goodyear production service division, from market analysis to delivery of products to shipping department, provides every facility for rapid manufacturing at lowest cost; control is function separate from actual production and has produced big savings in all operations.

RESEARCH IN. Research in Management, L. P. Alford. Soc. Indus. Engrs.—Bul., vol. 9, no. 7, July 1927, pp. 27-31. One of most necessary lines of management research should be to discover, formulate, declare and show how to apply basic laws of management.

TIME STUDY. *See Time Study.*

TREND. The Trend of Science in Management, D. S. Kimball. Soc. Indus. Engrs.—Bul., vol. 9, no. 7, July 1927 pp. 21-26. Address delivered in opening session of S.I.E. 14th National Convention, Chicago, May 25, 1927.

INDUSTRIAL PLANTS

LOCATION. Waterfront Industrial Sites Have Great Possibilities in Reducing Costs, H. S. Colburn. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 117-120, 6 figs. Factors to consider in choosing a site.

OBSOLESCENCE AND DEPRECIATION. Obsolescence and Depreciation, G. James. Taylor Soc.—Bul., vol. 12, no. 3, June 1927, pp. 442-446. Studied from management's point of view.

SAFETY. What Can the Small Plant Do About Safety? W. D. Keefer. Factory, vol. 39 no. 1, July 1927, pp. 56-57. Essentials of safety work are same in small plant as they are in large plant; general safety committee is an essential of effective safety work; use of safety posters, either home-made or those obtainable from Nat. Safety Council is urged.

INDUSTRIAL RELATIONS

CONCILIATION. Conciliation in Labour Disputes, H. L. Kerwin. Min. Congress Jl., vol. 13, no. 7, July 1927, pp. 502-504. Co-operation between employers and employees; industrial relations adjustment over 14-year period; violence giving way to peaceful settlements; prosperity created by new viewpoint of employer and employee.

INSULATION, ELECTRIC

MOULDED. Moulded Insulation, L. E. Barringer. Gen. Elec. Rev., vol. 30, no. 8. Aug. 1927, pp. 387-395, 5 figs. Functions of component materials; predominant characteristics; processes of moulding; relative advantages; manufacturing problems; properties, testing and design.

INSULATION, HEAT

MOISTURE, PROTECTION AGAINST. Protection of Insulation Against Moisture, C. H. Herter. Refrigeration, vol. 42 no. 1, July 1927, pp. 60-62. Compares old and new methods of protection; describes approved method of erecting cork-board insulation.

INTERNAL-COMBUSTION ENGINES

VOLUMETRIC COMPRESSION. Limit of Volumetric Compression in Internal-Combustion Engines (Au sujet de la limit de compression volumétrique dans les moteurs à explosion), M. P. Dumanois. Société d'Encouragement pour l'Industrie Nationale—Bul., vol. 126, no. 1, Jan. 1927, pp. 36-42, 4 figs. Discusses transition from combustion to detonation in gases and reviews recent researches of Lafitte and of Lafitte and Dumanois; distance traversed by combustion phase diminishes with rising initial pressure.

See also Airplane Engines; Automobile Engines; Diesel Engines; Oil Engines.

IRON METALLURGY

SPONGE IRON. Production of Sponge Iron, C. E. Williams, E. P. Barrett and B. M. Larsen. U.S. Bur. Mines—Bul., no. 270, 1927, 166 pp., 48 figs. Sponge iron is product formed by reduction of iron oxide to metallic iron at temperature below fusion point of constituents of charge; under suitable reducing conditions, sponge iron can be produced readily on commercial scale at about 900 deg. cent. and can be magnetically separated from large part of associated impurities.

IRON ORE

REDUCTION. Low Temperature Reduction of Iron Ore, F. Hodson. Blast Furnace, & Steel Plant, vol. 15, no. 7, July 1927 pp. 329-330. Comparison of present method of producing iron in blast furnace with that of using gaseous fuel as reducing agent; new process attracting attention.

IRON AND STEEL

PROPERTIES AT HIGH TEMPERATURES. Armco Iron and Mild Steel at High Temperatures. Engineering, vol. 124, no. 3212, Aug. 5, 1927, pp. 181-182, 12 figs. From Special Report No. 1, Dept. of Scientific and Industrial Research, Engineering Research, covering armco iron and 0.17 and 0.24 carbon steel.

IRRIGATION

FINANCE. Some Phases of Irrigation Finance, D. C. Henny. Am. Soc. Civ. Engrs. Proc., vol. 53, no. 5, May 1927, pp. 896-912. Increase of irrigated area will and should be slow when and where crop prices do not render farming profitable; private enterprise will continue to bring about healthy irrigation expansion on small scale in many localities as soon as crop prices become generally profitable; irrigation districts will continue to play large part in financing of improvements of existing projects and, to some extent in construction of small new projects under especially favoured conditions; irrigation-district method is not well adapted to reclamation of large areas of desert land. See also discussion in Am. Soc. Civil Engrs.—Proc., vol. 53, no. 6, Aug. 1927, pp. 1351-1356.

L

LIGHTING

DAYLIGHTING. Cost of Daylight Illumination in Industrial Plants, M. Luckiesh. Indus. Engr., vol. 85, no. 7, July 1927, pp. 307-309, 2 figs. From viewpoint of uniform distribution of light over flfloor or other horizontal planes, overhead skylights are generally superior to windows in walls; however, use of skylights limits buildings to one-storey construction or involves use of light courts.

TEXTILE MILLS. The Lighting of Textile Mills, J. G. Oliver. Elec. Rev., vol. 150. no. 2590, July 15, 1927 pp. 91-93, 2 figs. Consideration of difficulties of electrical engineer in facing problem of mill lighting, and suggestions for their solution.

LIMESTONE

METALLURGICAL. Production and Utilization of Metallurgical Limestone, O. Bowles. Cement, Mill & Quarry, vol. 31, no. 2, July 28, 1927, pp. 36-46 and 52. Purpose and action of blast-furnace flux; effect of impurities; basic open-hearth flux; dolomite as furnace lining; general features in quarrying fluxing stone; impurities in limestone; maintaining uniformity in rock composition.

LOCOMOTIVES

CYLINDER LOSSES. Cylinder Losses in Compound Locomotives. Ry. Engr., vol. 48, no. 571, Aug. 1927, pp. 313-315, 3 figs. An investigation based on tests made in service with an L.M.S.R. 3-cylinder 4-4-0 type engine.

DESIGN AND CONSTRUCTION. Report on Locomotive Design and Construction. Ry. & Locomotive Eng., vol. 40, no. 7, July 1927 pp. 199-201. Standardization of fundamental parts of locomotives; rail stresses under locomotives; use of 3-cylinder vs. 2-cylinder locomotives; provision for expansion of locomotive boilers on frames and firebox supports; exhaust-steam ejectors; advantages and disadvantages of boiler pressures higher than 200 lb.; and development and use of oil-electric locomotives in railway service.

DIESEL-ENGINED. Diesel Locomotives for Trunk Lines (Les locomotives Diesel à grand parcours), M. Seiliger. Technique Moderne, vol. 19, no. 14, July 15, 1927, pp. 417-424, 12 figs. Deals with Diesel-engined locomotives with minimum of 1,000 h.p.; difficulties encountered and how to overcome them.

LIMITED CUT-OFF. Full Gear vs. Limited Cut-Off, H. J. Vincent. Ry. Age, vol. 83, no. 5, July 30, 1927, pp. 219-221, 4 figs. Discusses advantage obtained by limiting cut-off from standpoint of capacity and economy in locomotive operation.

OIL-ELECTRIC. Impressive Service Record of Oil-Engine Locomotives. Oil Eng. Power vol. 7, no. 8, Aug. 1927, pp. 521-522, 1 fig. Railroad records on comparative performance of steam and oil-electric locomotives, surveyed for first time by Ingersoll-Rand Co., show to advantage of oil-electric type a possible saving of $337,000,000 per year. Oil-electric operating cost for fuel. oil, water and other engine supplies found to be only one-fourth that of steam.

LUMBER INDUSTRY

PACIFIC NORTHWEST. The Logging and Lumbering Interests of the Pacific Northwest. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 819-895, 31 figs. Symposium of following contributions: The Engineer in the Lumber Industry, J. J. Donovan; Logging Railroads, W. J. Ryan; Skyline Methods Used for Logging, K. Berger; Logging Flumes, U. B. Hough; Logging Inclines, H. G. Cowling; Ocean Log Rafts, W. T. Evenson; The Engineering Aspects of Saw-Mill Construction and Operation, B. L. Grondal; Electrification of Logging and Mill Equipment O. D. Beach; Economic Aspects of Reforestation, E. T. Allen; Reforestation, J. B. Woods. Discussion, Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 6, Aug. 1927, pp. 1345-1349.

M

MACHINE SHOPS

EQUIPMENT. Shop Equipment Review. Am. Mach., vol. 67, no. 3, July 21, 1927, pp. 77-140, 483 figs. Semi-annual résumé of machines, tools and accessories described in Shop Equipment News section of this journal during first six months of 1927 includes index of manufacturers and résumé of European equipment.

MACHINING METHODS

AIRPLANE ENGINE PISTONS. Methods of Machining Pistons for Airplane Engines, F. H. Colvin. Am. Mach., vol. 67, Aug. 18, 1927, pp. 261-263, 8 figs. Fixtures, tools and methods of the Curtiss Aeroplane and Motor Co. that are well adapted for use in shops having a limited production.

MAGNESIUM

COMMERCIAL POSSIBILITIES. Magnesium. Metallurgist (Supp. to Engineer), June 24, 1927, pp. 81-82. Improvement of magnesium and its alloys or of their treatment in regard to corrosion resistance stands in forefront of problems to be solved before serious advances can be made with those metals; it is, however, problem for investigator which should not prove ultimately beyond solution.

MALLEABLE IRON

WHITE-HEART. The Influence of Manganese and Manganese Sulphide on White-Heart Malleable, E. R. Taylor. Foundry Trade Jl., vol. 36, nos. 568 and 569, July 7 and 15, 1927, pp. 23-24 and 41-44, 10 figs.

MANGANESE STEEL

LOW-CARBON. Alloys of Iron and Manganese Containing Low Carbon, Robert Hadfield. Iron and Steel Inst.—Advance Paper, May 1927 65 pp. and supp. plates, 17 figs. Report of a research to ascertain definitely the properties conferred by manganese itself upon iron in the practical absence of carbon. See also Engineering, vol. 124, nos. 3211 and 3212, July 29 and Aug. 5, 1927, pp. 148-151 and 184-186, 13 figs.

MATERIALS HANDLING

COST REDUCTION BY. Cutting Your Handling Costs, G. E. Hagemann. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 99-102, 7 figs. Description of materials-handling methods that have saved money.

LIFT-TRUCK SYSTEM. Lift-Truck System Cuts Handling Costs, W. C. Stuebling. Can. Machy., vol. 38, no. 2, July 14, 1927, pp. 25-27, 5 figs. One man with lift-truck system can do work of five men with old-fashioned trucks, where latter require loading and unloading.

RAILROAD SHOPS. Material Handling System in a Railroad Shop. Am. Mach., vol. 67, no. 7, Aug. 18, 1927, pp. 275-277, 6 figs. System at Union Pacific Shops, Omaha, Nebr.

MERCURY VAPOUR

DETECTION. A New Method for Detecting and Measuring Mercury Vapour, B. W. Nordlander. Nat. Safety News, vol. 16, no. 1, July 1927, pp. 37-38. Apparatus has been worked out by which standard conditions of test can be maintained constant; by means of this it is now possible to determine mercury-vapour concentration in any desired locality.

MERCURY-VAPOUR PROCESS

ECONOMIES OF. Economies of the Emmet Mercury Process, W. L. R. Emmet. Gen. Elec. Rev. vol. 30, no. 7, July 1927, pp. 339-341, 2 figs. Efficient means of enlarging existing plants; design of equipment; economies effected by use in combination with typical plants; results of application.

METALS

DEFORMATION AND STRESS DISTRIBUTIONS. Surface Deformations and Stress Distribution in Tensile Test Pieces (Les déformations superficielles et la distribution des efforts dans les éprouvettes detraction). Génie Civil, vol. 91, no. 1, July 2, 1927, pp. 10-13, 28 figs. Studies by Ch. Frémont which explain formation of lines in tensile test pieces and which permit deduction of method of investigation of stress distribution in metals.

FRACTURE. Cause of Formation of Internal Hollow Spaces in the Rupture of Tensile Test Pieces (La cause de la formation de la coupelle dans la rupture des éprouvettes essayées à la traction), Fremont. Génie Civil, vol. 90, no. 19, May 7, 1927, pp. 453-456, 47 figs. Results of investigation of this type of fracture.

PRECIOUS. Precious Metals in the Sudbury Ores and Their Recovery, C. Langer and C. Johnson. Can. Min. & Met.—Bul., no. 183, July 1927, pp. 878-883. Precious metals values of different Sudbury ores vary considerably, and are generally higher in copper-rich ores; recovery of minute quantities of precious metals out of large amount of gangue and sulphides of iron, copper and nickel.

METEOROLOGY

WEATHER FORECASTING. Weather Bureau Aid in Ocean Flying, D. W. Clephane. Aviation, vol. 23, no. 2, July 11, 1927, pp. 84-86. Upper air charts furnished by U.S. Weather Bureau do much to enable trnnsoceanic airman to plot his course and avoid bad conditions.

MICA

PRODUCTION. Mica, W. M. Myers. Can. Min. Jl., vol. 48, no. 30, Aug. 5, 1927, pp. 622-624. Prospecting; mining methods, trimming and cutting. From Information Circular No. 6064, U.S. Bureau of Mines.

MILLING MACHINES

PRODUCTION OPERATIONS. Production Operations on a Modern Manufacturing Milling Machine. Brit. Machine Tool Eng., vol. 4, no. 35, May-June 1927, pp. 612-614 4 figs. Typical and efficient manufacturing methods of production on a Parkinson No. 13 manufacturing milling machine.

MINERAL DEPOSITS

REPLACEMENT VS. INJECTION. Microscopic Replacement vs. Injection in Ores, G. M. Schwartz. Am. Mineralogist, vol. 12, no. 8, Aug. 1927, pp. 297-304, 12 figs. Presents some of microscopic evidences of replacement or of possible injection; thousands of specimens.

MINES

ACCIDENT PREVENTION. Mine Accident Prevention. W. Boncer. Min. Congress Jl., vol. 13, no. 7, July 1927, pp. 550-551. Cut-throat competition contributory factor; mines can be made safe; recommendations to reduce toll include use of proper equipment and care in employing and managing men; state and nation should safeguard life and health of miners.

MINING

BRITISH COLUMBIA. A Sketch of Mining in British Columbia, T. A. Rickard. Eng. & Min. Jl., vol. 124, no. 2, July 9, 1927, pp. 56-58. Review of annual report of Minister of Mines for year ending Dec. 3, 1926.

ELECTRICITY IN. Electricity in Mines, J. F. Perry. Electricity, vol. 41, no. 1916, July 29, 1927, pp. 537-539, 1 fig. Methods of securing greater safety in use of electricity in mines.

EQUIPMENT. Selecting a Mining Plant, H. V. Haight. Can. Min. Jl., vol. 48, no. 30, July 29, 1927, pp. 600-604, 20 figs. Power supply, air compressor, hoist, drills, sharpening equipment; pumps, typical plants.

MINING METHODS

CONVEYOR MINING. Reports on the Mechanization Survey, G. B. Southward. Min. Congress Jl., vol. 13, no. 8 Aug. 1927, pp. 598-602, 4 figs. Four conveyor mining operations in modified room and pillar systems; different methods of pillar recovery; shaking and chain conveyors.

MONEL METAL

STEAM-TURBINE BLADES. Monel Metal for Steam Turbine Blades (L'emploi du metal Monel pour l'ailettage des turbines à vapeur). Génie Civil, vol. 90, no. 17, Apr. 23, 1927, pp. 416-417.

N

NATURAL GAS

ESTIMATING RESERVES. Problems in Estimating Gas Reserves, R. R. Brandenthaler. Oil & Gas Jl., vol. 26, no. 6, June 30, 1927, pp. 40 and 93. Economic and engineering factors most important; companies concerned with constancy of their supply.

NICKEL

Canada. Nickel—Past and Present, R. C. Stanley. Can. Min. & Met.—Bul., no. 183, July 1927, pp. 844-877, 3 figs. Early history; market development in post-war period; present industrial uses of nickel; forms of nickel commercially available; typical compositions of industrial nickel products; principal industrial uses of nickel and nickel products. Bibliography.

Ontario Deposits. The Sudbury Basin E. D. Loney. Can. Min. Jl., vol. 48, no. 28, July 15, 1927, pp. 567-568. Description of Sudbury nickel field.

NITROGEN

Synthetic. Development of the Synthetic Nitrogen Industry, G. P. Pollitt. Chem. Age, vol. 17, no. 420, July 16, 1927, pp. 53-55. Processes, plants and chemical and technical difficulties.

NICKEL STEEL

Nickel-Chromium-Molybdenum. The Properties of Some Nickel-Chromium-Molybdenum Steels, J. H. Andrew, M. S. Fisher and J. M. Robertson. Iron & Coal Trades Rev., vol. 114, no. 3092, June 3, 1927, pp. 892-893. Deals with properties of two series of steels; in both series percentages of chromium and molybdenum were constant, and nickel increased from 2 to 5 per cent; thermal data; mechanical properties. Abstract of paper read before Iron and Steel Inst.

NON-FERROUS METALS

Castings Stresses in. Stresses in Non-Ferrous Castings, C. H. Desch. Metal Industry (Lond.), vol. 31, no. 2, July 15, 1927, pp. 28-30, 3 figs. Contraction data of chief metals; brittle range; intercrystalline stress; beta brass structure. Paper read at Institute of British Foundrymen.

O

OIL ENGINES

Airless Injection. A 675-B.H.P. Airless Injection Oil Engine for British Columbia. Engineer, vol. 144, no. 3734, Aug. 5, 1927, pp. 156-157, 4 figs. Built by Campbell Gas Engine Co., Ltd., at Halifax for Vancouver Station of the British Columbia Electric Light and Power Co., Ltd. Westinghouse 2,300-volt, 3-phase, 60-cycle alternators designed for an output of 450 kw. at 0.8 power factor, synchronous speed 225 r.p.m.

Power Costs. Power Costs with Modern Oil Engines, Edgar J. Kates. Oil Eng. Power, vol. 7, no. 8, Aug. 1927, pp. 530-532. Importance of basing cost studies on up-to-date records.

OIL FUEL

Combustion. The Chemistry of Oil Combustion, P. E. Fansler. Heat. & Vent. Mag., vol. 24, nos. 6 and 7, June and July 1927, pp. 63-65 and 72-74. Present-day theory identifies gasified hydrocarbons as elementary fuel.

ORE SMELTING

Electrical Equipment. Modern Electrical Equipment in Smelting and Refining Plants, E. Gealy. Eng. & Min. Jl., vol. 124, no. 4, July 23, 1927, pp. 124-125, 4 figs. Tread is definitely toward turbo-generator electric power; a.c. machinery reduces labour and maintenance costs.

OSCILLOGRAPHS

Cathode-Ray. On the Determination of the Directions of Rotation of Cathode-Ray Oscillograph Diagram, M. Kobayashi. Inst. Elec. Engrs. of Japan—Jl., no. 467, June 1927, pp. 635-648. Author introduces two methods for determination of direction of rotation; principle of them is based on superposition of certain kinds of e.m.f. on plate voltage. (In Japanese.)

P

PAVEMENTS

Concrete Bases. The Pavement Base Situation, J. H. Neeson. Pub. Works, vol. 58, no. 7, July 1927, pp. 247-250. Causes of failures of concrete bases; preparation of subgrade; faulty concrete due to poor material, hasty mixing, poor workmanship, excess of water, ignorance of collusion—seldom last; increased richness, thickness and reinforcement.

PAVEMENTS, ASPHALT

Design and Advantages. The Design, Construction and Advantages of Asphalt Pavements, P. Hubbard. Contract Rec., vol. 41, no. 26, June 29, 1927, pp. 655-658. Rigid and flexible bases; how rich concrete should be; importance of lateral restraint to prevent displacement along sides; proper compaction an important item. Paper read before Am. Soc. Civil Engrs.

Mixtures. Asphalt Paving Mixture Practice, A. W. Dow. Can. Engr., vol. 53, no. 4, July 26, 1927, pp. 165-167. Brief statement of what has so far been accomplished and some of fundamental principles that are still insufficiently understood.

PIERS

Vancouver, B.C. Massive New Pier for C.P. Terminal. Port & Terminal, vol. 7, no. 2, Mar. 1927, pp. 9-12. New pier which will berth largest trans-Pacific liners in their service and also ships of other lines; structure is 1,100 ft. long by 331 ft. wide; substructure being of reinforced concrete and two-storey headhouse of structural steel, while only timber construction used is single-deck freight sheds.

PIPE, CAST-IRON

Improvements. Recent Developments in Cast-Iron Pipe, H. Y. Carson. Can. Engr., vol. 52, no. 26, June 28, 1927, pp. 633-634, 3 figs. Improvements in pipe manufacture; casting pipe by centrifugal process; bronze-welding broken mains; cement-lined pipe. Paper presented at Am. Water Wks. Assn.

PIPE, CONCRETE

Centrifugally Cast. Unique Method of Making Concrete Pipe by Centrifugal Force, G. Oliver. Modern Irrigation, vol. 3, no. 5, May 1927, pp. 11-13 and 24, 5 figs. Product which is nearly as dense as marble; new line is being installed near riverside.

PIPE LINES

Corrosion. Prevention of Corrosion in Steel Pipe Line, W. K. Weller. Water Works, vol. 66, no. 7, Aug. 1927, pp. 342-343, 1 fig. How deaeration process is used on 350-mi. line in Western Australia described in paper presented Feb. 27 at annual conference of Institution of Engineers, Australia.

Expansion Joint. Applications of the Modern Expansion Joint, H. L. Alt. Heating & Ventilating Mag., vol. 24, no. 8, Aug. 1927, pp. 83-85, 7 figs. How these devices compare with pipe bends in solving piping problems both above and below ground.

Flexibility. Testing Flexibility of a Pipe Line. Power House, vol. 21 no. 14, July 20, 1927, pp. 21-22, 4 figs. Indicates importance of sag in water mains, and describes original test applied to flexible coupling designed to avoid leak or fracture in underground mains as result of soil subsidence or other cause.

PISTONS

Light-Alloy. Light-Alloy Pistons, G. D. Welty. Soc. of Automotive Engrs.—Jl., vol. 21, no. 2, Aug. 1927, pp. 146-150, 1 fig. Lightweight and high conductivity; design of aluminum pistons; installation; magnesium-alloy pistons.

PORTS

Montreal. The Western Ports of the North Atlantic, Brysson Cunningham. Engineering, vol. 124, no. 3212, Aug. 5, 1927, pp. 157-162, 26 figs. partly on supp. plate. Port approaches; piers and quays; grain handling; electrified railway system; Montreal harbour bridge; impending developments.

Vancouver B.C. The Port and Harbour of Vancouver, British Columbia, W. G. Stickney. World Ports—Bul., vol. 15, no. 9, July 1927, pp. 963-977, 8 figs. History of developments.

POWER PLANTS

Savings in. Saving Money in the Power Plant, H. E. Collins. Mfg. Industries, vol. 14, no. 2, Aug. 1927, pp. 129-131. In three instances savings give yearly return of 58.5, 58 and 37 per cent on cost of new equipment; coal and ash-handling machinery; in four instances savings in operating expenses are 23, 19, 13.5 and 11.8 per cent.

PULVERIZED COAL

Hydrocarbons, Retention of. The Retention of Certain Hydrocarbons by Solid Fuels, B. Moore and F. S. Sinnatt. Fuel, vol. 6, no. 7, July 1927, pp. 312-318, 28 figs. Results of investigations show that relative amounts of vapour which fuels examined are capable of absorbing and retaining vary with type of fuel; most of absorbed vapour is easily removed, although measurable amount is retained during considerable periods of exposure to air; pre-treatment of fuels with hydrocarbons used has practically no influence upon capacities of fuels for absorbing moisture, but decreases slightly tendency of coals to ignite.

Plants. Up-to-the-Minute Powdered Coal Plant. Black Diamond, vol. 79, no. 6, Aug. 6, 1927, pp. 14-15, 3 figs. S. D. Warren Co., Cumberland Mills, Me., uses CE unit pulverizers grinding 5,000 lb. per hr.; burner is No. 3 Couch rotary type; coal is not dried.

PUMPING STATIONS

Design and Future Development. Modern Pumping Station Design and Its Probable Future Development, A. L. Mullergren. Am. Water Works Assn.—Jl., vol. 18, no. 2, Aug. 1927, pp. 180-192. Also Can. Engr., vol. 53, no. 1, July 5, 1927, pp. 105-108.

PUMPS, CENTRIFUGAL

Automatic Control. Notes on the Automatic Operation of Centrifugal Pumps, E. B. Wagner. General Elec. Rev., vol. 30, no. 8, Aug. 1927, pp. 370-374, 1 fig.

Characteristics. Characteristics of Centrifugal Pumps, H. F. Meeker. Ice & Cold Storage. vol. 30, no. 353, Aug. 1927, pp. 203-206, 3 figs. The size and type required and other useful information for the refrigerating engineer.

Efficiency. Centrifugal Pump Efficiency, L. G. L. Thomas. Armour Engr., vol. 18, no. 3, Mar. 1927, pp. 88-90 and 116, 6 figs. Pump must be carefully selected if efficient operation is to be secured. Pump impeller must rotate at speed sufficient to lift water to desired height. Author considers method of pump selection which will insure economical results.

Electric. Electric Pumps for Standby Service, W. E. Davis. Can. Engr., vol. 53, no. 2, July 12, 1927, pp. 125-127. Economies effected by installation of motor-driven centrifugal pumps in water works plants; comparison between three plants operating under different conditions. Paper presented before Am. Water Works Assn.

Operating Costs. Cost of Operating Motor Driven Centrifugal Pumps, L. Hudson and A. J. Richards. Water Works, vol. 66, no. 8, Aug. 8, 1927, pp. 339-341. Data on pumping operations at McKeesport, Pa., given in paper presented before Central States Section of Am. Water Works Assn.

Selection. Guaranteed Efficiencies Do Not Afford a True Basis for Comparing Centrifugal Pumps, G. H. Gibson. Textile World, vol. 72, no. 6, Aug. 6, 1927, p. 74. Pump with discharge nozzle smaller than suction nozzle may give too good a showing.

R

RADIOTELEGRAPHY

Frequency Amplification. A Mathematical Study of Radio Frequency Amplification, V. G. Smith. Inst. Radio Engrs.—Proc., vol. 15, no. 6, June 1927, pp. 525-536, 6 figs. Deals chiefly with tuned type of transformer for neutrodyne and similar circuits.

Short-Wave. Some Practical Aspects of Short-Wave Operation at High Power, H. E. Hallborg. Inst. Radio Engrs.—Proc., vol. 15, no. 6, June 1927, pp. 501-517, 11 figs. Propagation characteristics; frequency stabilization; comparison of crystal control circuits; features of design and adjustment of 20-kw. amplifier; antenna and field systems; static on short-wave circuits; destiny of the short wave.

Short-Wave Commercial Long-Distance Communication, H. E. Hallborg, L. A. Briggs and C. W. Hansell. Inst. Radio Engrs.—Proc., vol. 15. no. 6, June 1927, pp. 467-499, 23 figs. Development of short-wave communication by Radio Corpn. of America; summary of short-wave installations; traffic charts showing diurnal and seasonal characteristic of various wavelengths over typical circuits; technical problems inherent to development of tubes and transmitter circuits; methods for obtaining proper operation of tubes and transmitters at these very short wave-lengths.

Broadcasting. A Statement on Engineering Principles Prepared for Presentation to The Federal Radio Commission by the Committee on Radio Broadcasting of American Engineering Council. Soc. Induc. Engrs.—Bul., vol. 9, no. 4. Apr. 1927, pp. 15-19.

RAILS

A.R.E.A. Report on. Report of Committee IV—Rails, E. Stimson. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 295, Mar. 1927, pp. 915-919. Revision of manual; details of mill practice and manufacture as they affect rail quality; rail failures; transverse fissures; cause and prevention of rail battering; gas welding of propulsion and signal bonds; economic value of different rail sections.

Heat Treatment. The Heat Treatment of Steel Rails. Metallurgist (Supp. to Engineer), July 1927, pp. 104-105, 1 fig. Rev. de Met., Jan. and Feb. 1927, the Sandberg process; abstracted from Rev. de Met., Jan. and Feb. 1927, pp. 10-19 and 68-78.

Stresses. Stress in Rails Has Important Bearing on Failures. Ry. Age, vol. 83, no. 3, July 16, 1927, pp. 107-108, 3 figs. Records kept by P. & L. E. show that breakages vary with the relation of wheel loads to stiffness of sections.

Wear. The Problem of Railway Wear. Ry. Engr., vol. 48, no. 570, July 1927, pp. 278-279. Facts indicate that mere carbon hardness is not prime requisite in steel-rail composition, but that manganese plays a greater part than carbon in producing that toughness that is best fitted to withstand peculiar combination of pounding and rubbing which rail suffers when in service; specified "higher carbon" compositions of British Standard Specifications should be subdivided, and definite manganese percentages specified, somewhat after this fashion.

RAILWAY CONSTRUCTION

A.R.E.A. Report on. Report of Committee I—Roadway. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 295, Mar. 1927, pp. 839-840. Revision of manual; unusual methods of handling problems in connection with slips, slides and water pockets; methods of drainage of roadway in yards and main lines where there are three or more tracks; improved methods of preventing corrosion of fence wire; specifications for steel fence posts; methods and advisability of constructing permanent roadbed; outline of work for ensuing year.

RAILWAY ELECTRIFICATION

France. Electrification of Railways of the South of France (L'Electrification des Chemins de Fer du Midi). Génie Civil, vol. 91, nos. 5 and 6 July 30 and Aug. 6, 1927, pp. 105-115 and 133-138, 26 figs.

RAILWAY MOTOR CARS

Gasoline-Electric. New Double-Unit Petrol-Electric Cars, J. W. Inglis. Tramway & Ry. World, vol. 61, June 16, 1927, pp. 291-293, 4 figs. Brill-Westinghouse cars with power units.

RAILWAY SHOPS

Air Compressors. Yard Compressors Save Money at Busy Freight Terminals. Ry. Elec. Engr., vol. 18, no. 8, Aug. 1927, pp. 245-248, 7 figs. Estimated savings average more than 30 per cent on the investment; automatic control features permit their use at outlying points

RAILWAY SIGNALLING

Automatic Block. Seaboard Proves Value of Signals. Ry. Age, vol. 83, no. 3 July 16, 1927, pp. 91-94, 3 figs. Automatic block signalling reduces average running time of freight trains 56 minutes on 95-mile district.

A.R.A. Reports. Instruction (Committee V). Am. Ry. Assn.—Signal Section Proc., vol. 25, no. 1, Aug. 1927, pp. 50-101, 12 figs. Reports on following subjects: Book on signalling: Chapter VII—direct current track circuits; Chapter XXIII—highway-crossing protection; definition for technical terms used in signalling.

Signalling Practice (Committee X). Am. Ry. Assn.—Signal Section Proc., vol. 25, no. 1, Aug. 1927, pp. 5-41, 10 figs. Reports on following subjects: Automatic train control; definitions for display of light signal indications and aspects; requisites for display of light signal indications and aspects; signal aspects, signal indications and names of indications.

Automatic Bloc. Direct Current Automatic Block Signalling (Committee IV). Am. Ry. Assn.—Signal Section Proc., vol. 25, no. 1, Aug. 1927, pp. 110-126. A.R.A. reports on following subjects: Revision of A.R.A. signal division specification 10520; revision of R.S.A. specification 5716; revision of A.R.A signal division specification 10620.

Mechanical Interlocking. Mechanical Interlocking (Committee II). Am. Ry. Assn—Signal Section Proc., vol. 25, no. 1, Aug. 1927, pp. 144-170. A.R.A. report on revision of R.S.A. specification 6618.

Power Interlocking. Power Interlocking (Committee III). Am. Ry. Assn—Signal Section Proc., vol. 25, no. 1, Aug. 1927, pp. 187-254, 8 figs. A.R.A. reports on revision of R.S.A. specification 6518; typical circuits for power interlockings; specification for automatic signal protection for railroad grade crossings.

RAILWAY TIES

Concrete. Pennsylvania Starts Extensive Tests of Concrete Ties. Ry. Eng. & Maintenance, vol. 23, no. 3, Aug. 1927, pp. 333-335, 3 figs. Is now installing several thousand substitute ties in main tracks on the eastern and central regions; design of tie which is to carry locomotive wheel load of 127,200 lb. (including impact allowance).

Scrap Rails. Metal Railroad Ties Constructed from Scrap Rails, W. Dalton. Iron & Steel (Can.), vol. 10, no. 6, June 1927, pp. 167-169, 5 figs. Points out substitute that is many times stronger than wood tie, and one that can be tried extensively at very low cost.

RAILWAY TRACK

Inspection Car. A.T. & S.F. Track Inspection Car Has Interesting Features. Ry. Eng. & Maintenance, vol. 23, no. 3, Aug. 1927, pp. 316-321, 10 figs. Makes graphical record of various characteristics of track for guidance of track forces; gyroscope has been utilized to record differences in cross level of rails at high speed.

Sidings. Group of Sidings: Calculations and Comparisons, P. Amigoni. Internatl. Ry. Congress Assn.—Bul., vol. 9, no. 7, July 1927, pp. 594-601, 11 figs. It is necessary to decide upon relative position of groups of sidings and connecting lines, and then consider points leading into the different groups.

RECLAMATION

State. State Reclamation in Washington, R. K. Tiffany. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 913-923. Conclusions as to proper functions of state with reference to reclamation; state is not justified in expending funds raised by tax on all property, including agricultural land and products, to increase agricultural area by reclamation; programme as far as it can be outlined should include: (1) comprehensive study of possibilities and needs of state for increased agricultural production by means of reclamation; (2) continued effort to improve state laws relating to reclamation; state should support national reclamation policy and programme based on sound, economic principles. See also discussion in Am. Soc. Civ. Engrs.—Proc., vol. 53 no, 6, Aug. 1927, pp. 1357-1364.

RECTIFIERS

Mercury-Arc. Mercury-Arc Rectifier Phenomena, D. C. Prince. Am. Inst. Elec. Engrs.—Jl., vol. 46, no. 7, July 1927, pp. 667-674, 21 figs. Presents such information as is at present available to author.

REFRACTORIES

Industrial Furnaces. Troubles of the Furnace Builders with Refractories. Forging—Stamping—Heat Treating, vol. 13 no. 6, June 1927, pp. 231-233. Conditions that exist in certain types of furnaces are considered together with character of refractories that will meet these conditions; deals with underfired normalizing furnaces, enameling furnaces, brass-melting furnaces.

REFRIGERATING PLANTS

Electric. Electrical Driving of Refrigerating Plant. Ice & Cold Storage, vol. 30, no. 353, Aug. 1927, pp. 201-202. Some points on the characteristics of a.c. and d.c. motors.

REFRIGERATION

Direct Heat Application. Refrigeration by Direct Application of Heat, H. E. Keeler. Am. Gas Jl., vol. 127, no. 3, July 16, 1927, pp. 56-61. Fundamental principles and discussion of commercial aspects of subject.

Domestic. Household Refrigeration. A Study of the Factors Affecting the Capacity and Efficiency of Small Reciprocating Compressors, L. A. Philipp and C. C. Spreen. Refrig. Eng., vol. 14, no. 2, Aug. 1927, pp. 61-70 and 75, 8 figs. Confirms previous results with new data; defines compression efficiency, mechanical efficiency, overall compressor efficiency, Carnot efficiency, performance factor; compares results of two cases—variable and constant room temperature—to show the effect of this factor on capacity. The volumetric efficiencies measured are compared with those obtaining when air is fluid compressed.

RESEARCH

Academic and Industrial. Research, R. E. Rose. Science, vol. 66, no. 1701, Aug. 5, 1927, pp. 117-122. Presented at a joint meeting of the Rhode Island Sections of the Am. Chemical Soc. and the Am. Assn. of Textile Chemists and Colorists.

RESERVOIRS

Water-Level Recorder. The Graphic Water-Level Recorder, C. C. Covert. Water Works, vol. 66, no. 8, Aug. 1927, pp. 331-334, 6 figs. How it is used as aid in operation of reservoirs and filter plants described in paper presented June 10th at 47th annual convention of the Am. Water Works Assn.

RETAINING WALLS

Low. Low Retaining Walls, L. Turner. Concrete & Constr. Engr., vol. 22, no. 7, July 1927, pp. 450-460, 6 figs. Refers to construction of comparatively shallow retaining walls up to about 6 ft. total height, and of any length, such as would be suitable for supporting bank of earth up to, say 4 ft. 6 in. high.

ROAD CONSTRUCTION

Cost Control. Control of Construction Unit Costs, T. W. Allen. Can. Engr., vol. 53, no. 3, July 19, 1927, pp. 143-146. One phase of highway design that affects construction costs discussed in paper presented at annual meeting of Am. Road Bldrs'. Assn.; proper location, design, construction and maintenance also of great importance.

Tests. When May Roads Be Opened to Traffic? H. F. Clemmer. Can. Engr., vol. 53, no. 5, Aug. 2, 1927, pp. 191-192. Field testing of concrete for pavements; practice of opening roads when concrete has increased in strength to that used in design formula; simple Cantilever method of test-accelerating curing of concrete.

ROADS, ASPHALT

Patching. Asphalt Pavement Patching Methods, W. E. Rosegarten. Highway Engr. & Contractor, vol. 17, no. 1 July 1927, pp. 38-41, 6 figs. Relaying methods; cold-mix materials; hot-patch methods; equipment for mixing; patching costs.

ROCK DRILLS

Selection, Care and Use of. Selection, Care, Use and Standardization of Mine Drill Equipment, J. E. Harding. Min. Congress Jl., vol. 13, no. 8, Aug. 1927, pp. 609-611, 2 figs. Three types of rock drills; necessity for thorough knowledge of material to be encountered; relation between speed and yardage; standardization essential; selection of drill steel discussed; drill expert invaluable on tempering.

ROLLING MILLS

Blooming Mills. Blooming Mills Given Electric Drive. Iron Age, vol. 120, no. 4, July 28, 1927, pp. 203-204 1 fig. Reversing motor of 4,000 h.p. installed by Bourne-Fuller Co.; better product reported at lower cost.

Sheet Bar. Changing Mills with Minimum Delay. Iron Age, vol. 120, no. 7, Aug. 18, 1927, pp. 394-396, 6 figs. Careful preparation of an operating schedule and a construction programme enabled the Inland Steel Co. to switch from an existing 24-in. three-high mill to a new 19-in. continuous sheet bar mill with an interruption of only 12 days in production.

Sheet Mills. Continuous Sheet Mill at Ashland, Ky., C. Longenecker. Blast Furnace & Steel Plant, vol. 15, no. 7, July 1927, pp. 335-338, 9 figs. Methods involved are explained, from casting of ingot to finished sheet.

Minimizes Heating Costs of Steel Sheets, F. W. Manker. Iron Trade Rev., vol. 81, no. 4, July 28, 1927, p. 200, 1 fig. Development of new and modern equipment for efficient and economical utilization of gas fuel at plant of the West Penn Steel Co., Brackenridge, Pa.; soaking pits, sheets and pair furnaces, box-annealing furnaces and drying ovens are all fired with gas.

Soaking Pits. Soaking Pit with Recuperator. Blast Furnace & Steel Plant, vol. 15, no. 7, July 1927, pp. 347-349, 2 figs. Recuperation applied to "pits" in European plants with satisfactory results; installation in American mill increases efficiency; advantages pointed out.

Structural Steel. Carnegie Structural Mill at Homestead, R. H. Wright. Blast Furnace & Steel Plant, vol. 15, no. 7, July 1927, pp. 331-334. By electrical appliances, mills at Munhall are started from New York City; production of steel outlined; project involves complete reconstruction of department used in production of structural steel.

Wire-Rod. Making of Wire Rods, G. A. Richardson. Wire, vol. 2, no. 7, July 1927, pp. 230-232, 6 figs. Improved methods and machinery at Sparrows Point plant of Bethlehem Steel Co.

ROLLS

Wear of. Wear of Blooming-Mill Rolls, H. Cramer. Iron & Coal Trades Rev., vol. 115 no. 3098, July 15, 1927, pp. 96-98, 9 figs. Wear of rolls in service is made good by turning them down; to restore original width in worn roll, passes are cut with sloping sides, thus tapering off rolls to certain extent; one way of minimizing quantity of roll metal to be removed is described for three-high blooming mill. Translated from Stahl u. Eisen.

S

SAND

Bituminous, Alberta. The Bituminous Sands of Alberta, K. A. Clark and S. M. Blair. Scientific and Industrial Research Council of Alberta—Report, no. 18, 1927, 74 pp., 3 figs. on supp. pl. Occurrence of bituminous sands, their accessibility, variability and other economic features.

SCALES

Track. Pennsylvania Builds the First Plate Fulcrum Master Scale. Ry. Age, vol. 83, no. 4, July 23, 1927, pp. 136-140, 7 figs. New weighing device with unusual accuracy and sensitivity.

SEWAGE DISPOSAL

Los Angeles, California. The Sewage Disposal Problem of Los Angeles, California W. T. Knowlton. Am. Soc. of Civil Engrs.—Proc., vol. 53, no. 6, Aug. 1927, pp. 1213-1226, 1 fig. How outfall sewers required for this area have been planned; data on basis of design; problem of ocean disposal of effluent from screening plants and final disposal of sewage screenings; in addition to sanitary sewage, disposal of industrial waste is problem.

Sewage-Flow Control. Automatic Control of Sewage at the Syracuse Sewage Treatment Plant, E. F. Sipher. Am. City, vol. 37, no. 1, July 1927, pp. 6-9, 4 figs. Method employed to control rate of flow of sewage through grit chamber, which makes use of automatically controlled motor-operated pumps to maintain velocity of sewage within close limits, without excessive loss of head.

SHAPERS

Crank. Kelly 26- and 32-Inch N.T. Crank Shapers. Am. Mach., vol. 67, no. 5, Aug. 4, 1927, pp. 207-208. Machines are equipped with plates at back of column for bolting motor for motor drive; single-pulley drive can also be obtained.

SHEARS

PLATE. Plate Shearing Machines. Mech. World, vol. 81, nos. 2105, 2108, 2110 and 2113, May 6, 27, June 10 and July 1, 1927, pp. 317-318, 372-373, 407- and , 8 figs. Main features of design in machines for shearing heavy steel plates when these are delivered from rolling mill.

SILVER MINES

CANADA. The Silver Mining Industry in Canada, A. A. Cole. Can. Min. & Met.—Bul., no. 183, July 1927, pp. 807-843, 17 figs. Canada's position in world as producer of silver; production from Canadian ores, by provinces, 1887-1926; historical review of silver mining in Canada.

SMOKE ABATEMENT

METHODS. The Future of Coal and Its Relation to Smoke Abatement. Heating & Ventilating Mag., vol. 24, no. 8 Aug. 1927, pp. 88-89, 4 figs. What science is doing to eliminate objections to use of this fuel in every increasing quantity.

STAYBOLTS

HOLLOW BARS. Seamless Hollow Rolled Staybolt Bars. Boiler Maker, vol. 27, no. 7, July 1927, p. 200, 3 figs. Patented process to manufacture on production basis hollow staybolt iron; process consists essentially of building up hollow fagot by arranging rods around hollow metal core, heating fagot to welding and rolling temperature, rolling heated fagot down to required size, at same time preserving desired direction of hole through axis of bar.

STEAM

HIGH-PRESSURE, GENERATION OF. The Industrial Production of High-Pressure Steam (La production industrielle de la vapeur d'eau a haute pression), C. Roszak and M. Veron. Société des Ingenieurs Civils de France—Memoires et Comptes Rendu des Travaux, vol. 79, nos. 1 and 2, Jan.-Feb. 1927, pp. 334-336, 65 figs. Theory of high-pressure steam, advantages and disadvantages of high-steam pressure; history and present status of practice of generating high-pressure steam.

STEAM ENGINES

ECONOMY. High-Pressure Reciprocating Engines, Charles R. King. Engineer, vol. 144, no. 3733, July 29, 1927, pp. 129-130. Contains a tabular recapitulation of published results of steam-engine tests.

UNIFLOW. Uniflow Engines, R. Trautschold. Paper Trade Jl., vol. 85, no. 3, July 21, 1927, pp. 36-40, 2 figs. Some examples of savings by use of uniflow engines.

STEAM POWER PLANTS

ECONOMY IN. Further Economy in Steam Generation, E. V. Ahara. Engineering Journal, vol. 10, no. 8, Aug. 1927, pp. 386-389, 6 figs. Consideration of steam generating plants designed to burn pulverized coal and wood refuse. Paper read before the Sault Ste. Marie Branch of the Eng. Inst. of Canada, Feb. 25, 1926.

STEAM TURBINES

FORD. Ford Motor Company Designs and Builds Its Own Small Turbines. Power, vol. 66, no. 7, Aug. 16, 1927, pp. 232-235, 5 figs. For use in its various assembly plants, Ford Motor Company has designed and constructed in its own shops number of turbine-generator units ranging in size from 75- to 5,000-kw.; this article describes in detail design of the 5,000-kw. unit and indicates main design features of some of smaller units.

SUPER-PRESSURE. 480-Kw. Super-Pressure Steam Turbo-Generator. Engineering, vol. 124, no. 3212, Aug. 5 1927, pp. 164-165, 12 figs. Description of a 480-kw. steam turbine built for 100 atmos. and 400 deg. cent.; rotor speed, 15,000 r.p.m.; generator, 3,000 r.p.m., 3-phase, 50 cycles, 525 volts. Built by The Tektiebolaget de Lavals Angturbin, Stockholm.

STEEL

BALL BEARINGS. Steel for Ball Races. Metallurgist (Supp. to Engineer), June 24, 1427, p. 83. Review of paper by Houdremont and Kallen, published in V.D.I. Zeit., July 31, 1926, on preparation and properties of ball-bearing steels; basic electric furnace is to be preferred to basic open-hearth, but it is preferable to work with pure scrap or Swedish charcoal iron; whole process resolves itself into melting charge and adding alloy constituents either in acid or basic open-hearth or electric furnaces; addition of chromium to steel causes marked increase of hardness and elastic limit.

MANGANESE. *See Manganese Steel.*

NICKEL. *See Nickel Steel.*

STEEL CASTINGS

LARGE, MANUFACTURE OF. Manufacture of a Large Steel Casting (La fabrication d'une grande piece en acier coule), F. A. Melmoth and T. H. Brown. Revue de Fonderie Moderne, vol. 21, July 25, 1927, pp. 221-231, 12 figs. Also translation in Foundry Trade Jl., vol. 36, nos. 568 and 569, July 7 and 14, 1927, pp. 19-22 and 45-48, 12 figs. Full description of process of casting support of propeller shaft, from first tests of casting, critical discussion of used metallurgical and moulding methods and their alternative.

STEAM CYLINDERS AND PISTON RINGS. Note on the Manufacture of Steam Cylinders for Locomotives and Piston Rings by the Paris-Orléans Railway Company, L. Audo. Foundry Trade Jl., vol. 36 no. 568, July 7, 1927, pp. 7-14, 11 figs. Notes on melting; manufacture; machining rings and boring cylinders; sand preparation; making of mould; annealing; welding.

STEEL, HEAT TREATMENT OF

ELECTRIC INSTALLATION. Electric Heat Treating Installation. Forging—Stamping—Heat Treating, vol. 13, no. 6, June 1927, p. 241. In plant burning natural gas substitution of electricity affected reduction both in cost of operation and in refections; temperature control more positive.

QUENCHING. A Practical Course in the Elements of Physical Metallurgy. Forging—Stamping—Heat Treating, vol. 13, no. 6, June 1927, pp. 237-240. Quenching; classification of quenching mediums; pyrometers.

STEEL, HIGH-SPEED

CUTTING TOOLS. Heat Treating is Critical Operation in Making Cutters and Tools, F. W. England. Iron Trade Rev., vol. 81, no. 5, Aug. 4, 1927, pp. 251-253, 4 figs. Describes high-speed steel hardening furnaces in plant of Illinois Tool Works, Inc.; laboratories equipped for chemical, metallurgical, microscopic and screen projection tests.

STEEL MANUFACTURE

BASIC OPEN-HEARTH. Making Basic Open-Hearth Steel, C. W. Veach. Blast Furnace & Steel Plant, vol. 15, no. 7, July 1927, pp. 323-325. Discusses several features such as furnace construction, operation, charging and heat control.

STREAM POLLUTION

PACIFIC NORTHWEST. Stream Pollution in the Pacific Northwest, W. F. Allison. Am. Soc. of Civil Engrs.—Proc., vol. 53, no. 6, Aug. 1927, pp. 1207-1211. Problems presented by pollution of streams and lakes in the states bordering on the north Pacific Ocean are different from those in older communities only in degree and acuteness.

SUBMARINES

STEEL FOR. Submarines Require Finest of Steel, H. R. Simons. Iron Trade Rev., vol. 81, no. 6, Aug. 11, 1927, pp. 311-314, 8 figs. General discussion of use of steel for submarine construction; requirements of steel for various parts.

SUBSTATIONS

SUPERVISORY SYSTEM. Supervisory System for Pittsburgh, V. H. Dake and H. C. Jones. Elec. World, vol. 90, no. 3, July 16, 1927, pp. 105-108, 3 figs. Superimposed on telephone circuit as simplex; light signals give indications of automatic substation conditions; details of installation and operation on Duquesne Light Co. system.

SUBWAYS

ROLLING STOCK. New Rolling Stock for the London Underground Railways. Ry. Engr., vol. 48, no. 570 July 1927, pp. 263-269 and 275, 6 figs. Construction details of motor and trailer cars used on the Edgware to Morden lines.

SUPERHEATERS

DESIGN. Modern Superheating. Power Engr., vol. 22, no. 256, July 1927, pp. 259-260. Position of superheaters; types of superheater elements; element joints; water-tube protection for walls; superheaters for pulverized fuel.

SURVEYING

AERIAL. Flying for Air Survey Photography. Instn. Aeronautical Engrs.—Jl., vol. 1, no. 7, July 1927, pp. 4-25 and (discussion) 25-34, 10 figs. Article deals with problems related to particular process of survey, making of mosaics with utmost economy of flying time and photographic material.

T

TAPS

DESIGN AND CONSTRUCTION. Design and Construction of Taps, A. L. Valentine. Machy. (Lond.), vol. 30, no. 771, July 21, 1927, pp. 489-493 5 figs. With special reference to taps having ground threads; fourth of series of articles.

TELEPHONY

TRANSMISSION. Composite Telegraphy and Telephony on Open Wire Lines, A. E. Thompson. Electricity, vol. 41, no. 1916, July 29, 1927, pp. 527-530, 7 figs. Composite telegraph and telephone system, instead of making telephone by-product of telegraph, has reversed matters, and generally is arranged to provide one earthed telegraph circuit over each of two conductors of a telephone circuit; equipment employed to separate telephone and telegraph current is called composite set, and consists of network of inductances and capitances which divide circuit into two branches, one for high-frequency (telephone) and other for low-frequency currents (telegraph).

TERMINALS, BUS

LOCATION. City Terminals for Suburban Buses W. Tufts. Bus Transportation, vol. 6, no. 8, Aug. 1927, pp. 441-444. Factors determining location are: (1) The directional origin and relative quantity of present and future intercity buses; (2) areas within city through which buses will not be able to operate permanently ;(3) relative need for terminals in various possible locations; (4) working out of an enduring balance between first three factors.

TEST CODES

LOW-PRESSURE HEATING BOILERS. What's Wrong with This Code? Heating & Ventilating Mag., vol. 24, no. 8, Aug. 1927, pp. 79-82. Basis proposed by A.S.H. & V.E. for rating low-pressure heating boilers.

TESTING MACHINES

BRICK, PORTABLE. A Portable Apparatus for Transverse Tests of Brick, A. H. Stang. U.S. Department of Commerce—Bur. of Standards, no. 341, May 31, 1927, pp. 347-352, 4 figs. Machine consists of equalizer apparatus for transverse tests of brick described in Bur. of Standards Tech. Paper no. 251, hydraulic jack, frame and Bourdon pressure gauges which indicate load; machine complete weighs 40 lb.

TEXTILE MACHINERY

GARNET-ROLLER. Garnet-Roller of Unique Design, D. M. Duncan. Can. Machy., vol. 38 no. 2, July 14, 1927, pp. 17-18, 3 figs. Describes construction of garnet-roller as example of device which may have application in other spheres than textile industry from its unusually practical nature.

TEXTILES

RAYON. Recent Developments in the Manufacture and Process of Rayon and Rayon Goods, F. W. Sturtevant. Textile World, vol. 72, no. 7, Aug. 13, 1927, pp. 38 and 43. Altering dyeing affinity of viscose; revised yarn table; basic colors on cellulose acetate.

TIME STUDY

STANDARDIZATION. The Value of Training and Standardization to Time Study Engineering, W. Hasselhorn. Soc. Indus. Engrs.—Bul., vol. 9, no. 3, Mar. 1927, pp. 7-9. Training of time-study engineers. Address delivered at meeting of Chicago Chapter, Feb. 24, 1927.

TIRES, RUBBER

RELATION OF ROAD TYPE TO WEAR. Relation of Road Type to Tire Wear, O. L. Waller and H. E. Phelps. Am. Soc. of Civil Engrs.—Proc., vol. 53, no. 6 Aug. 1927, pp. 1189-1206, 1 fig. Study of wear of automobile tires to determine destructive effect of different types of road surfaces on tread rubber in order that, as far as possible, surfaces may be so improved as to make cost of building and maintaining road surfaces and of operating traffic over them a minimum.

TOWN PLANNING

INDUSTRIAL, CANADA. Planning of Company Towns in Canada, J. A. Walker. Can. Engr., vol. 53, no. 3, July 19, 1927, pp. 147-150. Provision of adequate housing and proper living conditions for employees and their families discussed in paper presented at annual convention of Town Planning Inst. of Canada, Vancouver.

TRAFFIC

CONTROL. New York State Committee Urges Use of Standard Traffic Signals. Bus Transportation, vol. 6, no. 8, Aug. 1927, pp. 426-428, 4 figs. Simple, fundamental rules urged as a basis for relieving present unfortunate situation resulting from lack of uniformity in meaning of signal lights by a New York committee which carefully studied the question. See also Good Roads, vol. 70, no. 7, July 1927, pp. 311-317, 6 figs.

TRANSFORMERS

LOW-VOLTAGE. Building a Low-Voltage Transformer. B. Candlish. Power House, vol. 21, no. 12, June 20, 1927, pp. 25-27, 4 figs. Accuracy of design will depend upon materials used and class of workmanship, until data obtained by test of machine is available for correction of inaccuracies.

TRANSPORTATION

Railway and Highway. The Relation of Highway Transportation to the Railway, R. Budd. Am. Soc. Civil Engrs.—Proc., vol. 53, no. 5, May 1927, pp. 793-8 2. 2 figs. Superiority of railway for long-distance and bulk freight and passenger traffic is well established; motor-truck and bus competition is not a factor in those fields; extensive ownership of automobiles and large mileage of improved highways have resulted in loss of most of local passenger travel of railways, except in vicinity of largest cities; bus business promises to increase if better service can be given and if cost of operation can be reduced; recommended restrictions on motor-vehicle sizes, weights and speeds; equitable principles for interstate regulation. Discussion, Am. Soc. Civil Engrs.—Proc., vol. 53, no. 6, Aug. 1927, pp. 1319-1328.

V

VALVES

High-Pressure Stop. Mason's High-Pressure Stop Valve. Engineering, vol. 124, no. 3208, July 8, 1927, p. 60, 4 figs. Suitable for continuous service with steam with higher temperatures and pressures in use.

VENTILATION

Errors in System Design. Some Common Errors in the Design of Ventilating Systems and Fan Application, A. Hindley. Domestic Eng., vol. 47, no. 6, June 1927, pp. 113-115, 4 figs. Figures given are in most cases result of practical experience and test, and when used in design or alteration of subsequent installations have proved sufficiently correct for all practical purposes.

Industrial. Industrial Ventilation, with Particular Reference to Hot and Dusty Trades, C. P. Yaglou. Fuels & Furnaces, vol. 5, no. 8, Aug. 1927, pp. 977-985, 7 figs. Industrial dusts, fumes and vapours; their physiologic effects; their removal from air; temperature, humidity and air movement; effective temperature; influence of hot environments on output; seasonal variation in output; accidents, sickness and mortality in relation to temperature; acclimatization to high temperature and adaptation to muscular exercise; effects of profuse perspiration; influence of air movement and of clothing on output; problem of ventilating hot industries.

VOLTAGE REGULATION

Care and Adjustment of Regulators. Care and Adjustment of Voltage Regulators, W. H. Turner. Power, vol. 66, no. 6, Aug. 9, 1927, pp. 201-203, 3 figs. Care of relay and main contacts; dashpot construction.

W

WATER POLLUTION

Oil. Progress of Control in Oil Pollution, A. L. Fales. Can. Engr., vol. 53, no. 3, July 19, 1927, pp. 153-155. Sources of oil pollution and effect upon water supplies, and efforts which are being made to control situation described in paper presented at annual convention of Am. Water Works Assn.; control of pollution in Rhode Island.

WATER PURIFICATION

Pittsburgh. Story of the Effects Which Led to the Purification of the Water Supply of Pittsburgh and to the Elimination of Typhoid Fever from That Cause, J. O. Handy. Engrs'. Soc. of West Penn.—Proc., vol. 43, no. 3, Apr. 1927, pp. 179-192, 4 figs. History of its development.

Stream Pollution. Purification of Polluted Drinking Water, P. Hansen. Can. Engr., vol. 53, no. 6, Aug. 9, 1927, pp. 208-210. Relation between water purification and stream pollution control; sewage treatment alone inadequate.

WATER SOFTENING

Plant Operation. Operation of the New Water Softening Plant at Springfield, Illinois, C. H. Spaulding. Am. Water Wks. Assn.—Jl., vol. 18, no. 1, July 1927, pp. 60-70. Raw water is collected in well 60 ft. in diameter by 53 feet deep to which it flows by gravity from galleries or river or is pumped from tubular wells; low-lift pumps deliver raw water to dosing well; thence it passes to two parallel reaction chambers, where it is stirred by mechanical agitators; from mixing chambers water passes through two Dorr clarifiers in parallel, thence through settling basins having carbonating chambers at outlet ends and finally to eight filter units of rapid-sand type, chemical and bacteriological data on plant operation are summarized.

System, Selection of. Choosing a Water Softening System, H. M. Marsh. Power House, vol. 21, no. 14, July 20, 1927, pp. 19-20, 2 figs. Precautions that should be taken in choosing a zeolite water softening system, design, material and workmanship all having a bearing on satisfactory operation.

WATER SUPPLY

Chlorination. Chlorination of Water Supply of Chicago, A. E. Gorman. Water Works, vol. 66, no. 8, Aug. 1927, pp. 315-320, 4 figs. System of control, policy and procedure described in paper presented June 7 at 47th annual convention of Am. Water Works Assn.

WATER TREATMENT

Railways. Progress of Water Treatment on Railroads, R. E. Coughlan. Am. Water Works Assn.—Jl., vol. 18, no. 1, July 1927, pp. 55-59. Western railroads, due to poor quality of water available in their territories, have taken initiative in installation of water-treating facilities, and it is on western railroads that most marked improvement has been noticed; water treatment of Chicago and North Western; pitting of flufles and boiler corrosion.

WATER WORKS

Distribution Systems. Distribution Systems of Water Works, L. C. Hough. Can. Engr., vol. 53, no. 5, Aug. 2, 1927, pp. 183-184. Factors that should be considered in planning a distribution system to allow for increase in water demand.

Pumping Plants. Increasing Efficiency of Pumping Plants, F. Johnstone-Taylor. Water Works Eng., vol. 80, no. 15, July 20, 1927, pp. 1061-1062 and 1100, 2 figs. How best to determine efficiency of water works pumping plant and methods calculated to increase its usefulness.

WELDING

Electric. *See Electric Welding, Arc.*

Large Machine Parts. Arc Welding Eliminates Casting in A.C. Machines, E. S. Henningsen and A. P. Wood. Elec. Wld., vol. 90, no. 6, Aug. 6, 1927, pp. 257-259, 8 figs. Designers are endeavoring to eliminate castings wherever possible in alternating-current generators and motors and to substitute rolled-steel plate and structural steel fabricated by arc welding or bolting.

Machine Frames. Building Large Machine Frames in One Piece by Welding, R. E. Kinkead. Am. Mach., vol. 67, no. 7, Aug. 18, 1927, pp. 259-260, 2 figs. Substitution of welded steel for cast-iron frames.

WELLS

Artesian, Leakage. Locating Leakage in Artesian Wells, A. G. Fieldler. Water Works, vol. 46, no. 7, July 1927, pp. 291-294, 5 figs. Au-deep well current meter and its use in Rosewell artesian basin, New Mexico.

WIRE

Manufacture. Wire and Wire Nails in the Making, D. M. Duncan. Can. Machy., vol. 38, no. 4, July 28, 1927, pp. 15-17, 5 figs. Describes processes and machinery employed in manufacture of wire nails from crude commercial rod to finished product, as well as manner in which wire is drawn from original rod to final marketable state.

WIRE DRAWING

Steel. The Relation of Steel Quality to the Drawing of Steel Wire, E. A. Atkins. Wire, vol. 2, no. 7, July 1927, pp. 226-229 and 252, 22 figs. Segregated steel; surface defects and hollowness; effect of non-metallic inclusions; cause of wire "running out" or not sizing correctly; nature of hard inclusions.

WOOD PRESERVATION

A.R.E.A. Report on. Report of Committee XVII—Wood Preservation, F. C. Shepherd. Am. Ry. Eng. Assn.—Bul., vol. 28, no. 295, Mar. 1927, p. 1113. Revision of manual; service test records; preservative treatment of trunking and capping; marine piling investigations; treatment with creosote and petroleum; treatment with zinc chloride and petroleum; preparation of structural material before treatment; report on effect of steaming on wood; outline of work for ensuing year.

WOODWORKING PLANTS

Waste Disposal. Refuse Wood in Indiana Plant Handled and Fired Mechanically. Power Plant Eng., vol. 31, no. 16, Aug. 15, 1927, pp. 873-875, 6 figs. On account of its reliability, steadiness and ease of operation, fuel-handling system installed in heating plant of kitchen-cabinet manufacturing factory of the G. I. Sellers & Sons Company, at Elwood, Ind., is outstanding example of progress made in art of refuse wood-handling and burning.

Z

ZINC METALLURGY

Developments in. Some Possible Developments in Zinc Metallurgy, J. A. B. Foster. Min. Rev., vol. 19, no. 225, June 6, 1927, pp. 315-320, 1 fig. Hydro-electric processes; ammonia leaching—oxide production; chloride leaching; pyro-electric processes.

Leaching. Ammonia Leaching Process for Zinc Ores. Am. Zinc Inst.—Bul., vol. 10, no. 6, May-June 1927, pp. 107-112 and (discussion) 112-124, 2 figs. Description of process and results of experiments.

Retort Mixtures. Some Notes on the Effect of Reclaimed Retort Material and Zinc Oxide Upon the Physical Properties of Retort Mixtures. Am. Zinc Inst.—Bul., vol. 10, no. 6, May-June 1927, pp. 97-104 and (discussion) 104-107, 9 figs. Results of experiments indicate that all desirable qualities in clay retort cannot be obtained in one body mixture; some qualities must be sacrificed in order to build up others.

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A

ADHESIVES

MECHANICAL PROPERTIES. Adhesives and Adhesion, J. W. McBain and W. B. Lee. Indus. Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 1005-1008, 2 figs. Typical and significant data are presented for mechanical properties of a number of adhesives and adhesives with added substances; observations emphasize essential importance of "deformability" of an adhesive; both this and tensile strength depend upon such factors as degree of humidity; brittleness of an adhesive film may be greatly increased or entirely eliminated by appropriate additions; strongest adhesive film here measured is isinglass with a tensile strength of 8 tons to square inch in an atmosphere of 0 per cent humidity; weakest are the gums and sodium silicates with a tensile strength of only a few hundred pounds per square inch.

AERONAUTICS

AIRPLANE STATIONS. An Aeroplane Station in Mid-Atlantic, W. Hovgaard. Engineering, vol. 124, no. 3214, Aug. 19, 1927, pp. 223-224, 2 figs. Proposes the establishment at Faraday Hills of a specially designed ship with a 1,000-ft. flying deck and various conveniences.

AIR COMPRESSORS

CENTRIFUGAL. Centrifugal Compressors, B. L. Spain. Iron & Steel Engr., vol. 4, no. 8, Aug. 1927, pp. 363-368, 10 figs. Some of interesting problems encountered in the development of the centrifugal compressor or blower; contribution of producers of steel and other materials to development of art; steel-mill applications; available drivers; auxiliary features; other interesting applications; future developments.

AIR CONDITIONING

FILTERS. Code for Testing Air Filters. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 33, no. 8, Aug. 1927, pp. 519-521. Preliminary draught of code.

TEMPERATURE, HUMIDITY AND AIR MOTION. Report of Technical Advisory Committee on Temperature, Humidity and Air Motion, W. H. Carrier. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 33, no. 8, Aug. 1927, pp. 521-522.

AIRPLANE ENGINES

CARBURETOR AIR HEATERS. Carburetor Air Heater, P. B. Taylor. Aviation, vol. 23, no. 7, Aug. 15, 1927, p. 370, 2 figs. A development to eliminate carburetor operation difficulties.

AIRPLANES

COMMERCIAL. Airplanes for Commercial Aviation, A. H. G. Kokker. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 250-253, 3 figs. Safety of operation; airplanes must not be overloaded; cantilever wings of wood; use of brakes on airplane wheels; single- vs. multiple-engine airplanes.

NAVAL. Modern Naval Aircraft, L. B. Richardson. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 245-249, 4 figs. Requirements of various types; structural elements; all-metal plane yet to come; corrosion a great problem; five classes of plane required; amphibian and convertible planes; power-plant accessories; reducing resistance; need for power controls and adjustable and reversible propellers; future developments.

ALLOY STEELS

COPPER STEEL. Corrosion Resistance of Copper Steel. (Metallurgist (Supp. to Engr.), Aug. 1927, pp. 121-123, 2 figs. From an article by Dr. Daeves, in Stahl u. Eisen, no. 52, 1927, p. 1857.

High Copper in Steel Produces Poor Product. Iron Age, vol. 120, no. 8, Aug. 25, 1927, p. 468. German steel made from copper-bearing pig irons; sheet steel from this iron less amenable to dishing; surface is rough.

DETERIORATION. Deterioration of Alloy Steels in Ammonia Synthesis, J. S. Vanick. Chem. & Met. Eng., vol. 34, no. 8, Aug. 1927, pp. 489-492, 3 figs. Deterioration during the synthesis of ammonia of materials which originally possessed the requisite physical properties.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*
BRASS. *See Brass.*
BRONZES. *See Bronzes.*
COPPER. *See Copper Alloys.*
IRON. *See Iron Alloys.*

ALUMINUM ALLOYS

"ALCLAD." "Alclad," A New Corrosion Resistant Aluminum Product, E. H. Dix. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 259, Aug. 1927, 13 pp., 13 figs. A new corrosion resistant aluminum product which is markedly superior to present strong alloys; its use should result in greatly increased life of structural part; product, designed "Alclad," has been in course of development by the Research and Technical Departments of the Aluminum Company of America for some time.

ALUMINUM BRONZE. Aluminum Bronze, J. Strauss. Am. Soc. Steel Treat.—Trans., vol. 12, no. 2, Aug. 1927, pp. 239-273 and (discussion) 273-278 and 306, 8 figs. Present paper is a review of constitution, mechanical properties and resistance to corrosion of these aluminum-copper alloys with and without addition of other elements; it is intended to provide those who up to present time have been largely interested in steel and its heat treatment with a survey of a portion of the non-ferrous field in which mechanical properties, heat treatment practice and other features are closely allied to those of some common ferrous products.

DURALUMIN. *See Duralumin.*

AMMONIA COMPRESSORS

IMPROVEMENTS. Ammonia Compressor and Valve Improvements. Power Plant Eng., vol. 31, no. 15, Aug. 1, 1927, pp. 838-839. Factors responsible for economy in compressors; relative merits of different types of valves discussed at meeting of the N.A.P.R.E. in New York.

ARCHES

DESIGN. The Design of Arches, W. E. Lilly. Instn. Civ. Engrs. of Ireland—Trans., vol. 52, 1927, pp. 163-200, 10 figs. Simplification of calculations required for design of arches.

ASBESTOS

RECOVERY FROM BEARING ROCK. The Recovery of Asbestos Fibre from Its Bearing Rock, A. M. Schofield. Min. & Indus. Mag., vol. 4, no. 12, Aug. 10, 1927, pp. 587-589. Description of new plant recently erected for United Asbestos Corp. of America; air swept tube shows remarkable results in increasing value of product; undamaged fibre recovered; fibre separated in ball mill and product removed by variable speed air current as soon as separated from rock.

AUTOMOBILE ENGINES

DETONATION. Detonation, A. W. Whatmough. Automobile Engr., vol. 17, nos. 230 and 231. July and Aug. 1927, pp. 260-263, 14 figs., and 306-311, 21 figs. Radiation of energy explained. Influence of engine design.

DUAL ENGINES. Dual Engines, W. F. Bradley. Autocar, vol. 59, no. 1658, Aug. 12, 1927, pp. 297-298, 5 figs. Interesting development in multi-cylinder engine design being tried by Fiat and Bugatti racing departments.

FUELS. *See Automotive Fuels.*

LUBRICATION. Engine-Cylinder Lubrication, L. T. Wagner. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 311-314. Comparisons are made between splash-feed and force-feed systems of lubrication, primary purpose being to suggest means for securing the best possible results from equipment already in use through promoting a better understanding of the variables in engine operation that affect cylinder lubrication directly; variables analyzed are: viscosity of lubricating oil, solid impurities accumulating inside engine, volatility of fuel, cylinder temperatures, engine-speed, intake-manifold depression and mechanical condition.

REGRINDING CYLINDERS AND CRANKSHAFTS. Reground Auto Motors Show High Efficiency. Abrasive Industry, vol. 8, no. 9, Sept. 1927, pp. 282-284, 6 figs. Methods used in regrinding cylinders and crankshafts.

AUTOMOBILES

BUMPERS. The Manufacture of Automobile Bumpers, C. H. Vivian. Forging—Stamping—Heat Treating, vol. 13, no. 8, Aug. 1927, pp. 297-299. To fulfill its purpose, this accessory must endure rough service; methods of manufacture to secure this endurance are related; compressed air used in operations.

AUTOMOTIVE FUELS

ANTI-KNOCK. Quantitative Anti-Knock Testing, C. K. Reiman. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 1055-1058, 1 fig. Method of measuring anti-knock quality of motor fuels developed in laboratories of A. D. Little, Inc., where it has been in constant use for more than a year, is explained in detail ;Dilco unit, after certain changes in field wiring, serves as dynamometer; speed, a very important factor in determining quantitative results, can be positively controlled electrically, serving as intermediate standard; this standard is provisionally placed on Edgar's absolute heptane-octane scale.

CARBURETANTS, BENZOL AS A. Benzol and Its Use as a Carburetant (Le Benzol et son emploi comme carburant), M. Bihoreau. Jl. des Usines à Gaz, vol. 51, no. 15, Aug. 5, 1927, pp. 313-323. General review of carburetants of vegetable and mineral origin; properties and advantages of benzol and benzol mixtures with gasoline and alcohol; benzol production statistics for France and world.

ETHYL ALCOHOL. Ethyl Alcohol Makes Good Showing in French Fuel Tests. Automotive Industries, vol. 57, no. 9, Aug. 27, 1927, pp. 302-303. Starting of engine more difficult than with gasoline, but in other respects results were up to standard; entrants divided into classes according to fuels used.

GASOLINES. Gasoline—Past, Present and Future, A. L. Clayden. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 277-280 and (discussion) 280-285, 7 figs.

KEROSENE. *See Kerosene.*

AVIATION

AIRPORTS. Location, Size and Layout of Airports, G. B. Ford. Am. City, vol. 37, no. 3, Sept. 1927, pp. 301-303. Factors to be considered in selecting airport site; types and location of hangars; auxiliary buildings.

DEVELOPMENTS IN UNITED STATES. Aviation in America, W. P. McCracken, Jr. Mun. & County Eng., vol. 72, no. 6, June 1927, pp. 284-291. Progress made in civil aviation; reliability of service; extent of air lines; air mail; increase of safety; financing of airports.

AXLES

CAR, FATIGUE CRACKS IN. A Study of Fatigue Cracks in Car Axles, H. Moore. Eng. Experiment Station—Univ. of Illinois Bul., vol. 24, no. 41, June 14, 1927, 22 pp., 9 figs.

B

BALANCING MACHINES

SMALL ARMATURES. Dynamic Balancing Machine for Small Armatures. Engineering, vol. 124, no. 3213, Aug. 12, 1927, pp. 203-204, 7 figs. Machine constructed on Lawaczeck-Heymann system by Messrs. Carl Schenck, of Darmstadt.

BEAMS

CONCRETE, REINFORCED. Steel Required for Bond in Reinforced Concrete Beams, R. T. Regester. Concrete, vol. 31, no. 3, Sept. 1927, pp. 19-20. Diagram and table useful in determining the perimeter of steel required for bond in beams of various sizes.

SHEARING STRESSES. Distribution of Shearing Stress in the Cross-Section of a Plated Beam. Mech. World, vol. 82, no. 2122, Sept. 2, 1927, pp. 164-165, 9 figs. Calculations to show that web of girder resists shearing forces, and that flanges resist bending moment due to loading.

BLAST FURNACES

REACTIONS IN. Iron Blast-Furnace Reactions, S. P. Kinney, P. H. Royster and T. L. Joseph. U.S. Department of Commerce—Bur. of Mines, no. 391, 1927, 65 pp., 34 figs. Describes and discusses work done in study of reduction of iron oxides in a 300-ton furnace when gases were sampled across a series of planes lying between the tuyere level and stock line.

BOILER FEEDWATER

HEATING. Extraction Heaters Increase Cycle Efficiency, K. S. Kramer. Power Plant Eng., vol. 31, no. 15, Aug. 1, 1927, pp. 817-819, 7 figs. Equal amounts of steam bled to different heaters give best results, but placing of heaters relatively unimportant.

Locomotive Feed Water Heating, W. C. Hamm. Ry. & Locomotive Eng., vol. 11, no. 8, Aug. 1927, pp. 225-231, 16 figs. Description of various types of heaters in use, their application and advantages effected under operating conditions.

BOILER FIRING

COKE BREEZE. Hunts Point Boilers Burn Coke Breeze. Power, vol. 66, no. 10, Sept. 6, 1927, pp. 350-352, 4 figs. The steam generated by the boilers of the Hunts Point by-product coke plant is used for driving plant auxiliaries and for the coke by-product processes.

PULVERIZED COAL. Pulverized Fuel Firing, E. G. Ritchie. Combustion, vol. 17, no. 3, Sept. 1927, pp. 169-172. An aid to economy in the manufacturing industries.

BOILER FURNACES

PULVERIZED COAL. The Design of Furnaces for Pulverized Coal, M. Frisch. Combustion, vol. 17, no. 3, Sept. 1927, pp. 159-163, 2 figs. Combustion problem; rate of combustion; importance of turbulence; difficulty of burning solid particles; imflammability; wall temperature and combustion; preheated air.

WATER-COOLED. Water-Cooled Furnaces, H. W. Leitch. Gas Age-Rec., vol. 60, no. 10, Sept. 3, 1927, pp. 325-326, 2 figs. Description of water-cooled furnaces at Hell Gate and Sherman Creek, New York.

BOILER PLANTS

INDUSTRIAL. Rational Design for Low Cost Steam, F. A. Combe. Power House, vol. 21, no. 16, Aug. 20, 1927, pp. 14 and 82. Emulation of large stations; economy considered, need for rational design; unusual methods used.

BOILER PLATE

EMBRITTLEMENT. Embrittlement of Boiler Plate, S. W. Parr and F. G. Straub. Engineering, vol. 124, no. 3213, Aug. 12, 1927, pp. 216-218. Paper presented at annual meeting of Am. Soc. for Test. Materials, French Lick, Ind., U.S.A., June 20-24, 1927.

BOILERS

ELECTRIC. Features of Electric Steam Generators, D. Robertson. Elec. News, vol. 36, no. 15, Aug. 1, 1927, pp. 31-33, 4 figs. Heat efficiency may attain 95 per cent, depending on feedwater; power-factor may be slightly leading; cast-iron electrodes best, with life about one year; steam at full load from cold start in five minutes.

The Economics of Electric Generation, P. S. Gregory. Elec. News, vol. 36, no. 17, Sept. 1, 1927, pp. 30-33. The value of electric steam boilers and the fallacy of electric house heating; attitude of mind of customer and company.

FAILURE DUE TO CRACKING. Investigations of Riveted Boiler Seams that Failed by Cracking. Power, vol. 66, no. 9, Aug. 30, 1927, pp. 340-343, 5 figs. Excerpts from paper by S. B. Applebaum, Assistant Technical Manager, The Permutit Co., read before the Nashville meeting of the National Board of Boiler and Pressure Vessel Inspectors.

STRESSES. Conditions of Elastic Limit or Bursting in Certain Cases of Hollow Bodies Subjected to Internal Pressure (Les conditions de limite elastique ou d'eclatement dans quelques cas de corps creux soumis a une pression interieure), J. Seigle. Revue de L'Industrie Minerale, no. 155 and 156, June 1, and 15, 1927, pp. 242-248 and 249-272, 26 figs.

BORING MACHINES

MOTOR-FRAME. Motor-Frame Boring, Facing and Recessing Machine. Engineering, vol. 124, no. 3215, Aug. 26, 1927, pp. 264-265, 5 figs. Description of a machine constructed by Smith & Coventry, Ltd., Manchester, England.

BRASS

FORGINGS. Brass Forging, O. J. Berger. Metal Industry (N.Y.), vol. 25, no. 8, Aug. 1927, pp. 321-323, 12 figs. Methods of manufacturing brass forgings and their advantages over castings.

BRASS FOUNDING

METALLURGY. Explains Brass Metallurgy, E. R. Thews. Foundry, vol. 55, nos. 15, 16 and 17, Aug. 1, 15 and Sept. 1, 1927, pp. 595-597, 639-642 and 683-686. Various phases of brass melting and metallurgy.

PRACTICE. The Fundamental of Brass Foundry Practice, R. R. Clarke. Metal Industry (N.Y.), vol. 25, no. 8, Aug. 1927, p. 327. Description of basic laws which control melting and casting of metals and their application to practical foundry operations. Aug.: Dry vs. green-sand moulds.

BRIDGE DESIGN

SKEW-ARCH REACTIONS. Skew-Arch Reactions Measured by Reciprocal Method. Eng. News Rec., vol. 99, no. 3, July 21, 1927, pp. 106-107, 2 figs. Influence contours determined by ingenious tests on hard-rubber model of 30-degree fixed-end arch.

BRIDGES, CONCRETE

MULTIPLE ARCH. Deep Steel Sheetpile Cofferdams at Arlington Bridge, C. Carswell. Eng. News Rec., vol. 99, no. 3, July 21, 1927, pp. 92-93, 3 figs. Foundation work for Arlington Memorial Bridge; large piers founded on rock within single-wall cofferdams; sheetpiles scaled to rock by grouting.

BRIDGES, HIGHWAY

ICE PROTECTION. Design of Ice-Breaker Pier Nose for Missouri River Bridges, J. E. Kirkham. Eng. News-Rec., vol. 99, no. 9, Sept. 1, 1927, pp. 354-355, 2 figs. Thickness and action of solid ice; splitting of ice cakes; pressures on piers; mush ice and ice gorges.

BRIDGES, STEEL

CARQUINEZ STRAIT, CALIFORNIA. Concrete Pavement on the Carquinez Bridge, L. Jennings. West. Constr. News, vol. 2, no. 14, July 25, 1927, pp. 42-43, 4 figs. Design and construction of concrete pavement.

RAILWAY. Construction of Bridge at Chute-a-Caron, D. C. Tennant. Can. Engr., vol. 53, no. 8, Aug. 23, 1927, pp. 237-238, 5 figs. Railway bridge erected over Saguenay river by Alcoa Power Co. for railway built to transport materials for large power development; concreting operations carried on in winter; methods employed in erecting steel superstructure.

BRIDGES, SUSPENSION

HUDSON RIVER. Design of 3,500-Ft. Suspension Bridge Across Hudson River. Eng. News-Rec., vol. 99, no. 6, Aug. 11, 1927, pp. 212-217, 6 figs. Huge public toll bridge to connect New Jersey with New York City; to be of suspension type using either wire or eyebar cables; stiffening trusses and lower deck will be omitted in first stage of construction; long-panel floor framing.

BRONZES

BEARING-METAL. Bearing-Metal Bronzes, H. J. Roast and F. Newell. Can. Min. Jl., vol. 48, no. 33, Aug. 19, 1927, pp. 651-659, 35 figs. Also Iron & Steel Can., vol. 10, no. 8, Aug. 1927, pp. 236-244, 35 figs. The essential constants of bronzes in every day use as determined by a series of tests with metals carried out under practical conditions. Paper read before the Montreal Branch of The Engineering Institute of Canada, Oct. 28, 1926.

BUILDING CONSTRUCTION

REINFORCED CONCRETE. Factors Affecting Use and Cost of Reinforced Concrete Buildings, W. W. Hay. Eng. News-Rec., vol. 99, no. 5, Aug. 4, 1927, pp. 188-189, 5 figs. Careful economic studies preceding design layout are valuable; graphs of relation of various factors in cost.

WELDLED STEELWORK. Welded Structural Steelwork, W. H. Thorpe. Engineering, vol. 124, no. 3213, Aug. 12, 1927, pp. 210-211. Brief description of welding of steelwork in building at Sharon Works at Westinghouse Electric and Mfg. Co.

BUILDINGS

REINFORCED CONCRETE, WIND PRESSURE ON. Assumed Wind Pressure on Tall Reinforced Concrete Buildings. Concrete, vol. 31, no. 3, Sept. 1927, pp. 36-38. Wind load requirements in building codes; variation in requirements; studies of buildings subjected to storms; actual wind stresses; designing against wind pressure.

C

CANALS

WELLAND, CANADA. The Welland Ship Canal. Engineer, vol. 144, no. 3736, Aug. 19, 1927, pp. 198-199, 2 figs. Some figures on canal, its locks and costs.

CARS

DUMP. Two-Way Side Hinged Dump Cars. Ry. Mech. Engr., vol. 101, no. 9, Sept. 1927, pp. 602-604, 2 figs. Describes new Magar cars; principal feature lies in operating mechanism of side doors; special valve mechanism permits dumping of entire train, or one or more cars, to either side.

DYNAMOMETER. The Dynamometer Car of the South African Railways. S. African Eng., vol. 38, nos. 2 and 3, Feb. and Mar. 1927, pp. 23-26 and 55-57, 3 figs. Feb.: Purchase of new rolling stock and engines; electrification schemes; new type of elevators; dynamometer car. Mar.: Instruments to ascertain power developed and speeds; articulated coaches; rail motor and road motor services.

CARS, FREIGHT

STANDARDIZATION. Standard Type Vehicles for Heavy Merchandise, L.M.S.R. Ry. Engr., vol. 48, no. 572, Sept. 1927, pp. 328-329, figs. on supp. plates. Describes and illustrates types selected for conveyance of heavy and bulky merchandise on London, Midland & Scottish Railway Co.

CAST IRON

FATIGUE. Tests of the Fatigue Strength of Cast Iron, H. F. Moore. Eng. Experiment Station—Univ. of Illinois Bul., vol. 24, no. 40, June 7, 1927, 47 pp., 26 figs. A report of an investigation conducted by the Engineering Experiment Station, University of Illinois, in co-operation with the Allis-Chalmers Manufacturing Company.

FLUIDITY. Test Bars to Establish the Fuidity Qualities of Cast Iron, C. Curry. Am. Foundrymen's Assn.—Advance Paper, no. 27-23, June 6-10, 1927, 18 pp., 14 figs. Definition, early investigation, description of test, application of test to non-ferrous work.

HEAT-TREATED. Heat-Treated Cast Iron. Metallurgist (Supp. to Engr.), Aug. 1927, pp. 116-118, 3 figs. Comments on paper by Prof. Piwowarsky at Sheffield Conference of Inst. of Brit. Foundrymen, July 5-8, 1927.

HIGH-DUTY. Effects of Nickel and Chromium on the Strength of Grey Cast Iron (Sur les effets du nickel et du chrome sur la resistance de la fonte grise), E. Piwowarsky. Fonderie Moderne, vol. 21, Aug. 10, 1927, pp. 243-250, 8 figs.

NICKEL AND CHROMIUM IN. The Economic Value of Nickel and Chromium in Grey Iron Castings, D. M. Houston. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 17 pp., 11 figs.

NICKEL CAST IRON. Alloy Cast Iron Meets High Duty Requirements. Am. Metal Market, vol. 34, no. 160, Aug. 18, 1927, p. 7, 4 figs. By use of nickel, or nickel and chromium in proper ratio, following improvements may be obtained: (1) Increased strength; (2) greater toughness; (3) uniformity increased hardness with better machinability; (4) reduction in chill; (5) increased wear resistance.

PRODUCTION OF. Progress in the Production of High Duty Cast Iron, E. Piwowarsky. Foundry Trade Jl., vol. 36, no. 18, Aug. 18, 1927, pp. 147-151, 1 fig.

STRENGTH OF. The Strength of Cast Iron, J. E. Fletcher. Foundry Trade Jl., vol. 36, nos. 570 and 571, July 21 and 28, 1927, pp. 69-72 and 89-92, 5 figs. Calls attention to variations in strength and gives typical examples; combined functions of total carbon and silicon; data presented refers to castings of about 1¼ in. diameter having approximately same cooling ratio.

TESTING. Principles of Testing, H. R. Pitt. Foundry Trade Jl., vol. 35, nos. 550 and 551, Mar. 3 and 10, 1927, pp. 193-194 and 213-215. Endeavors to formulate best methods of determining mechanical properties of cast iron and applying, as far as possible, recognized principles and methods of testing to measurement and assessment of its physical values; basic desiderata; theory of transverse testing. Mar. 10: Methods of expressing test results; transverse, fatigue, impact and hardness testing; shear.

TREATING. Improving the Quality of Grey Cast Iron (Amelioration des qualites de la fonte grise). Fonderie Moderne, vol. 21, Aug. 10, 1927, pp. 257-262. Compilation on various physical and chemical methods of cast-iron treating, including graphitization; Lanz method of making perlitic cast iron, Corsalli and Dechesne methods, etc.; results of mechanical tests.

CASTING

CENTRIFUGAL. Centrifugal Casting of Sheet Bars. Iron & Coal Trades Rev., vol. 115, no. 3102, Aug. 12, 1927, p. 227, 2 figs. Some economic possibilities of the process described by Leon Cammen before the American Society for Steel Treating.

The Centrifugal Casting Process, J. D. Capron. Blast Furnace & Steel Plant, vol. 15, no. 8, Aug. 1927, pp. 376-381. Art of centrifugal casting is reviewed from 1809 to present; deLavaud process employed for casting pipe fully explained; other methods given brief mention.

CASTINGS

Iron Alloys. The Production and Uses of Ni-Cr-Fe and Co-Cr-Fe Castings, J. Ferdinand Kayser. Iron & Coal Trades Rev., vol. 115, no. 3101, Aug. 5, 1927, pp. 202-203. Describes present status of these alloys for castings, and possible future use.

Stresses. Stresses in Non-Ferrous Castings, C. H. Desch. Foundry Trade Jl., vol. 36, no. 570, July 21, 1927, pp. 73-75, 4 figs. Shrinkage characteristics of various non-ferrous metals; from a paper read before the Sheffield Convention of the Institute of British Foundrymen. See also abstract in Brass World, vol. 23, no. 8, Aug. 1927, pp. 259-261, 3 figs.

CEMENT

Calcium Chloride, Effect of. Action of Calcium Chloride on Cements, M. Anstett. Pit. & Quarry, vol. 14, no. 11, Aug. 31, 1927, pp. 51-52. Describes series of experiments carried out by author to determine action of solution of calcium chloride on hydraulic binders.

CEMENT MANUFACTURE

Clinker Discoloration. Causes of Discoloration of Clinker, H. Shroder. Concrete, vol. 31, no. 3, Sept. 1927, pp. 103-104. Some observations on tests made to determine the causes of clinker discoloration and its effect on the quality of cement.

CENTRAL STATIONS

Heat Economy in. Heat Economy in Central Generating and Industrial Plants, H. L. Lewis. Commonwealth Engr., vol. 14, nos. 10 and 11, May 2 and June 1, 1927, pp. 391-398 and 439-443, 13 figs. May 2: Selection of most economical steam pressure; efficiency of high-pressure boilers and of modern steam turbo-generators; high steam temperatures; high-pressure steam and resuperheating. June 1: Fuel savings due to bleeding turbines at one or two successive stages for heating condensate; use of exhaust steam for heating purposes.

Power Factor Investigations. Power Factor Investigations, L. D. Price. Elec. World, vol. 90, no. 7, Aug. 13, 1927, pp. 301-304, 9 figs. Use of kilovolt-ampere demand meters for testing power-factor conditions in industrial plants; connections charts, reports; test precautions and calibrating facilities.

Short Circuits in. Short Circuit Phenomena in the Power Plant, W. F. Sutherland. Power Plant Eng., vol. 31, nos. 12, 14 and 16, June 15, July 15 and Aug. 15, 1927, pp. 681-683, 782-784 and 883-885, 9 figs. June 15: Outlines engineering problems due to short circuits on power systems. July 15: Calculation of probable magnitude of short circuit currents by use of percentage reactance. Aug. 15: Calculation of forces due to short circuits.

Steam vs. Water Power. Steam vs. Water Power. World Power, vol. 8, no. 44, Aug. 1927, pp. 80-82. Increasing economy of modern steam-generating stations is reducing commercial attractiveness of many hydro-electric developments—those that are developed must be fitted into existing systems.

Toronto. Auxiliary Steam-Electric Power Station and Central Heating Plant for Toronto. Contract Rec. and Eng. Rev., vol. 41, no. 31, Aug. 3, 1927, pp. 760-762. Report submitted by consulting engineers to Toronto hydro-electric commission recommends stand-by system; coking plant not justified at present time.

CHIMNEYS

Self-Supporting Steel. Self-Supporting Steel Chimneys, H. G. Neer. Mech. World, vol. 82, no. 2117, July 29, 1927, pp. 73-76, 1 fig. Illustration, tables and specification embody full details of 45 sizes of self-supporting brick-lined steel chimneys which have been found completely satisfactory in actual practice.

COAL

Carbonization. Low-Temperature Carbonization of Fuel, D. Brownlie. Power House, vol. 21, nos. 1, 2, 9, 14 and 15, Jan. 5, 20, May 5, July 20 and Aug. 5, 1927, pp. 26-27 and 48, 28-29 and 49, 37-29, 31-32 and 40 and 30-32 and 40, 14 figs.

Turner Low Temperature Carbonizer. Black Diamond, vol. 79, no. 10, Sept. 3, 1927, pp. 10-11, 1 fig. Turner process of low-temperature carbonization produces no permanent gases; all volatile constituents preserved in condensable form; quality of oil improved by freedom from pitch.

Cleaning. Air Table Coal Cleaning Plant, L. W. Huber. Modern Min., vol. 4, no. 8, Aug.-Sept. 1927, pp. 223-225, 3 figs. Coal less than 2½ inches is cleaned on arms air tables; satisfactory cleaning is effected; three sizes of coal shipped from plant of Pittsburgh Coal Co.

Pulverized. *See Pulverized Coal.*

Rhode Island, Utilization of. Electrolytic Gas to Enrich Low-Grade Fuel Gas, F. G. Clark. Elec. World, vol. 90, no. 7, Aug. 13, 1927, pp. 313-314. Proposes utilizing Rhode Island coal for generation of power and water gas; electrolytic gases made from off-peak power; relief gas holders and new type of gas making.

Storage. The Storage of Coal. Queensland Government Min. Jl., vol. 28, no. 326, July 15, 1927, pp. 271-273. Its deterioration and disintegration; dangers of spontaneous combustion; necessity of avoiding the accession of extraneous heat.

Tests of. Large Scale Tests of Ravine Gas Coal. Gas World, vol. 87, no. 2245, Aug. 13, 1927, pp. 143-146. From a technical paper by the Fuel Research Board (England); analysis; laboratory carbonization assay; carbonization tests and results; steam decomposed in retorts.

COAL HANDLING

Hydraulic Hoists. New Coal Hoists in South Wales. Engineer, vol. 144, no. 3735, Aug. 12, 1927, pp. 184-185. Description of five 30-ton hydraulically operated fixed coal-hoists erected in South Wales for lifting coal cars so that contents may be shot into ships and barges.

COAL MINES

Nova Scotia. Mining Coal Under the Sea in Nova Scotia, F. W. Gray. Colliery Guardian, vol. 124, nos. 3476, 3477 and 3478, Aug. 12, 19 and 26, 1927, pp. 394-397, 463-465 and 524-525, 14 figs. Coal mines at the Sydney coal field. Government regulations; future of undersea mining.

COMBUSTION

Gases. Oxygen Required for the Propagation of Hydrogen, Carbon Monoxide and Methane Flames, G. W. Jones and G. St. J. Perrott. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 985-989, 2 figs. Presented before the Division of Gas and Fuel Chemistry at the 73rd meeting of the Am. Chem. Soc., Richmond, Va., Apr. 11, 1927.

Liquid Fuels. Combustion of Liquid Fuels, E. A. Allcut. Power House, vol. 21, no. 16, Aug. 20, 1927, pp. 13-14. Liquid fuel is practically 100 per cent volatile matter, problem of combustion depending on three factors, time, space and opportunity; in all cases, turbulence is very considerable factor, increasing possibility of speeding combustion.

CONCRETE

Aggregates. The Determination of Free-Water Content Field Aggregates, R. P. V. Marquardson. Water Works, vol. 66, no. 9, Sept. 1927, pp. 355-356, 1 fig. A direct method for determining the percentage of free water in, or the percentage of lack of water for a full-absorption condition of, field aggregates used in concrete mixtures.

Distribution and Placing. Moving Concrete from Mixer to the Job, N. L. Doe. Contract Rec. & Eng. News, vol. 41, no. 32, Aug. 10, 1927, pp. 785-787. Various methods of distribution and placing compared; some lead to more segregation than others; a suitable set-up for one set of conditions may be unsatisfactory for another set.

Mica, Effect on. The Effect of Mica on Concrete, J. L. Hemmert. West. Constr. News, vol. 2, no. 16, Aug. 25, 1927, pp. 47-48, 3 figs. Data acquired during investigation at materials testing laboratory, University of Idaho, to determine effect of small percentages of mica, on both tensile and compressive strengths of concrete mortars.

Mixing Plant. Unique Mixing Plant on Mid-West Project. Eng. & Contracting, vol. 66, no. 8, Aug. 1927, pp. 349-354, 14 figs. Excavating with draglines, handling bulk cement, conveying aggregates by belt conveyors, handling mixed concrete by belt conveyors, handling seven-yard batches with cableway, and other unusual features utilized in building sewage disposal plant in Chicago.

Steam Curing. Steam Curing of Concrete Products, A. L. Miller. Concrete, vol. 31, no. 3, Sept. 1927, p. 45. 1 fig. The effect of hot water vapor on the rate of setting of Portland cement mortar; report of interesting series of tests at Univ. of Washington.

Tests for Fine Aggregate. Tests of Fine Aggregate for Concrete, S. E. Thompson and M. N. Clair. Roads & Streets, vol. 67, no. 8, Aug. 1927, pp. 351-353. Use of lumnite cement for short time tests to determine quality described in paper presented June 22 at 30th annual meeting, American Society for Testing Materials.

Water Permeability. Flow of Water Through Porous Concrete, W. G. Kirchoffer. Water Works, vol. 66, no. 9, Sept. 1927, pp. 351-354, 9 figs. Experiments on the loss in head when water is passed through porous concrete cast new light on a concrete slab that would make a good substitute for well screens and pipe manifolds and strainers in filter bottoms.

CONCRETE CONSTRUCTION

Floors and Roof. Floor and Roof Slabs, L. Turner. Concrete & Constr. Engr., vol. 22, no. 8, Aug. 1927, pp. 495-505, 5 figs. Floor or roof slabs capable of carrying a superload of 1 cwt. per square foot exclusive of dead load of the slab itself, and distributed if required over the whole area of the slab.

CONDENSERS, STEAM

Costs. The Relative Cost of Condensing Plants, D. G. McNair. Power Engr., vol. 22, no. 258, Sept. 1927, pp. 341-342 and 344. Comparison of the initial and operating costs of surface and jet condensers.

CONSTRUCTION WORK

Winter. Winter Construction Methods and Plant, C. S. Hill. Eng. News-Rec., vol. 99, no. 9, Sept. 1, 1927, pp. 332-336, 4 figs. Planning and servicing winter construction; construction materials, lubricants, explosives; camp and job servicing of labour; transportation service; fuel protection; power service.

CONVEYORS

Bearings and Lubrication. Cutting Down Power Costs on Mechanical Handling Equipment, A. F. Brewer. Indus. Mgmt. (N.Y.), vol. 74, no. 2, Aug. 1927, pp. 101-105, 9 figs. What modern bearings and lubrication methods mean to economical operation.

Cotton Mills. Planning a Cotton Mill Around the Conveyor System, C. M. Mumford and M. G. Farrell. Indus. Mgmt. (N.Y.), vol. 74, no. 2, Aug. 1927, pp. 94-100, 15 figs. Proof of what modern handling methods can do in a traditionally conservative industry.

COOLING TOWERS

Design of. Design of Cooling Towers, T. J. Guerritte. Ferro-Concrete, vol. 19, no. 2, Aug. 1927, pp. 37-45, 5 figs. Reinforced concrete used in construction.

COPPER

Canada. Canadian Copper and Its Production, C. P. Browning. Can. Min. & Met. Bul., no. 184, Aug. 1927, pp. 944-972, 12 figs. Principal occurrences in Canada; bibliography; paper presented before Vancouver meeting of Empire Mining and Metallurgical Congress, Sept. 14, 1927.

COPPER ALLOYS

Heat Treatment. The Effect of Heat Treatment on Some Mechanical Properties of 85:15 Copper-Tin Alloy, R. J. Anderson. Am. Metal Market, vol. 34, no. 160, Aug. 18, 1927, pp. 3-6, 13 figs. Metallographic constitution of alloy; prior work on heat treatment of copper-tin alloys; method of investigation; results of tests; microscopic examination; copper-tin alloy; conclusions; bibliography.

COST ACCOUNTING

Electrical Industry. What Does It Cost? S. L. Whitestone and F. H. Corregan. Elec. World, vol. 90, nos. 11 and 12, Sept. 10 and 17, 1927, pp. 515-517 and 569-571, 6 figs. Study of uniform cost system, use of which will enable executive to make correct determination of costs with due regard for all factors involved; capital, material, labour, manufacturing costs, etc.

Public Utilities. Accounting Treatment of Depreciation, L. L. Starrett. Elec. World, vol. 90, no. 11, Sept. 10, 1927, pp. 511-512. Utilities in past have failed to provide accurate records of invested capital; an analysis is here given of method devised for exact accounting.

COTTON MILLS

Turbine Drive. Cotton Spinning and the Turbine Drive. Power Engr., vol. 22, no. 258, Sept. 1927, pp. 331-335, 7 figs. Existing boilers modernized, geared turbine installed and shafting and wheel drives superseded by ropes in Lancashire mill.

CRANES

Railway Wrecking. Railway Breakdown Cranes, E. G. Ficgehen. Ry. Engr., vol. 48, no. 572, Sept. 1927, pp. 330-331 and 333. Consideration of some of difficulties encountered in their design, together with suggested solutions.

CRANKSHAFTS

Stresses. Crankshafts for Airless-Injection Engines, A. Porter. Brit. Motor Ship, vol. 8, no. 89, Aug. 1927, pp. 182-183, 2 figs. Consideration of the stresses involved.

CRUCIBLES

Graphite. The Use of Graphite Crucibles. Metal Industry (N.Y.), vol. 25, no. 8, Aug. 1927, pp. 324-326. Statistics on use of crucibles.

CUPOLAS

Air Control. The Importance of Air Control in Efficient Cupola Practice, P. H. Wilson. Foundry Trade Jl., vol. 36, nos. 569 and 571, July 14 and 28, 1927, pp. 49-54 and 83-88, 15 figs. Efficient working of any cupola depends primarily on quantity of air supplied at suitable pressure according to its capacity; melting capacity of cupola is determined by its effective diameter at melting zone; method of introducing air into furnaces; number and shape of tuyeres; maximum thermal efficiency is obtained when carbon is burned to CO_2 in one stage.

Linings. Compares Cupola Refractories, G. S. Schaller. Foundry, vol. 55, no. 17, Sept. 1, 1927, pp. 693-694 and 699. Describes results of extended series of experiments designed to show best materials and best method of application for lining used in cupola.

Mechanical Chargers. Mechanical Charger Feeds Three Cupolas, F. G. Steinebach. Foundry, vol. 55, no. 15, Aug. 1, 1927, pp. 599-603, 10 figs. Equipment installed at Cleveland plant of Westinghouse Elec. & Mfg. Co.

CYLINDERS

Locomotive Repairing. The Electric-Arc Process in Repairing Cylinders, J. M. Vossler. Am. Mach., vol. 67, no. 9, Sept. 1, 1927, pp. 335-338, 10 figs. Advantages of repairing cracked or broken locomotive cylinder by electric-arc process. Placing deposited metal in proper spot; positioning bolts; bridging space.

D

DAMS

Concrete. Building a High Concrete Arch Dam in a Narrow Canyon. Eng. News-Rec., vol. 11, no. 5, Aug. 4, 1927, pp. 168-170, 4 figs. Pacoima dam being built in mountains near San Fernando, Cal., as part of Los Angeles County Floor Control project, will have total height of 385 feet.; construction plant in restricted space of extremely narrow, tortuous canyon; automatic and mechanical features developed to marked degree so that operating force required is comparatively very small.

Problems in Concrete Dam Construction on the Pacific Coast, A. S. Bent. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1723-1726. This paper is an attempt to suggest, from long experience, fundamental elements that must be carefully and intelligently considered in advance to make a success of concrete dams and to outline some of methods of meeting specific problems.

Combined Railway Bridge and Dam Built at Outlet of Grand Lake, Newfoundland, A. B. McEwen. Eng. News-Rec., vol. 99, no. 4, July 28, 1927, pp. 128-132, 7 figs. Hollow dam, 1,050 fet. long and 80 ft. high, built on foundation of porous rock; underlying rock grouted; long temporary crib dam built to unwater stream during early stages of construction.

Multiple-Arch. Design of Multiple-Arch Dams, B. F. Jakobsen. Eng. & Contracting, vol. 66, no. 8, Aug 1927, pp. 357-360, 4 figs. Advantages of using an arch with central angle of 180 degrees.

Spillways. Pondage Important Factor in Spillway Design, M. D. Casler. Eng. News-Rec., vol. 99, no. 4, July 28, 1927, pp. 133-136, 3 figs. Length of spillway may be reduced when pondage is large; flood crest reduced and retarded by accumulation of water above spillway.

DIESEL ENGINES

Chemical Industry. The Place of the Diesel Engine in Chemical Industry, E. J. Kates. Indus. & Eng. Chem., vol. 19, no. 8, Aug. 1927, pp. 874-878, 7 figs. Advantages of Diesel engines; reliability; costs; Diesels for secondary power; stand-by applications.

Design. Recent Suggestions in Diesel-Engine Construction, F. E. Bielifeld. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 425, Aug. 1927, 25 pp., 47 figs. Translated from Schiffbau, June 2, 16 and July 7, 1926. See Engineering Index, 1926, p. 232.

Foos. Higher Speeds, Lighter Weight in New Foos Diesels, M. A. Hall. Automotive Mfr., vol. 69, no. 5, Aug. 1927, pp. 5-7, 3 figs. Advanced ideas incorporated in new model bring marked reduction in weight and bulk, increase in speeds and power development; possible application widened.

Fuel Systems. Fuel Systems of the High-Speed Diesel Engine, W. M. Kaufmann. Power, vol. 96, n. 10, Sept. 6, 1927, pp. 358-359, 3 figs. Discussion of present practices in fuel pumps; outline of high-speed requirements; advantages of various systems.

Small Capacity. Small Capacity Diesel Engines (Les moteurs de faible puissance), R. Perisse. Comptes Rendue des Travaux de la Société des Ingenieurs Civils de France—Memoires, vol. 80, nos. 3 and 4, Mar.-Apr. 1927, pp. 451-456. Brief description of some European types of capacities as low as 6 h.p.; among them Rochefort engines for automobiles and industrial uses.

Textile Mills. The Widening Field of the Diesel Engine Includes the Textile Industry. Textile World, vol. 72, no. 10, Sept. 3, 1927, pp. 62-63, 3 figs. Description of modern two-cycle Diesel; textile installations; speedier and lighter engines.

DRILLING MACHINES

Radial. Radial Drilling Machine Design, H. Bentley. Mech. World, vol. 82, no. 120, Aug. 19, 1927, pp. 127-128, 9 figs. Improvements are (1) increased drilling capacity; (2) increased work-supporting capacity; (3) simpler, easier and more rapid control.

Spindle Attachment. A Useful Drilling Machine Accessory. Brit. Machine Tool Eng., vol. 4, no. 46, July-Aug. 1927, p. 638, 1 fig.

DURALUMIN

Defects and Failures. Duralumin—Defects and Failures, W. Nelson. Aviation, vol. 23, no. 9, Aug. 29, 1927, pp. 476-478, 4 figs. Some of the defects and failures in duralumin most frequently encountered by aircraft industry with view to indicate their importance.

DYNAMOMETERS

Telescopic. Telescopic Dynamometers (Les dynamometres telescopiques), M. R. Guillery. Revue de Metallurgie, vol. 24, no. 7, July 1927, pp. 401-404, 3 figs. Description and tests of light-weight portable dynamometers, of capacity as high as 50 tons compression, specially adapted for regulation of ball-test machines.

E

ELASTICITY

Calculation of Electric Deformation. A Method of Approximate Calculation of the Elastic Deformation, K. Okuda. Soc. of Mech. Engrs.—Jl. (Japan), vol. 30, no. 123, July 1927, pp. 319-334, 3 figs.

ELECTRIC DISTRIBUTION

Rural Rates. A Southern Rural Rate, E. W. Ashmead. Elec. World, vol. 90, no. 12, Sept. 17, 1927, pp. 562-566. In form of graduated service charge based on customer density with low energy charge; classifying rural customers into four density groups and provision for seasonal features.

ELECTRIC DISTRIBUTION SYSTEM

Dispatchers' Board. Dispatchers' Facilities for Supervising Operation of Widespread System, A. R. Leinbach. Elec. World, vol. 90, no. 12, Sept. 17, 1927, pp. 555-557. Features of new board, including manual and remote control of signals; symbols for identifying voltage and apparatus; communication and metering.

ELECTRIC FURNACES

Forging and Hardening. Notes on the Use of Electric Power for Forging, Normalizing and Hardening Drill Steel Bits. S. African Inst. of Elec. Engrs.—Trans., vol. 18, May 1927, pp. 71-82. Discussion of a paper by E. D. Brunner.

High-Speed Frequency Inductive. High-Speed Frequency Inductive Heating, E. F. Northrup. Metal Industry (Lond.), vol. 31, nos. 3 and 5, July 22 and Aug. 5, 1927, pp. 51-53 and 101-103, 6 figs. Paper read before American Electrochemical Society.

ELECTRIC GENERATORS

Relay Protection. Relay Protection of Queenston Generators, T. R. Miller and J. C. Martin. Elec. News, vol. 36, no. 17, Sept. 1, 1927, pp. 33-34, 5 figs. 450,000 kv.a. at Hydro's Niagara station protected by underground neutral system.

ELECTRIC RAILWAYS

Overhead Contact. The Collection of Current from Overhead Contact Wires, R. E. Wade and J. J. Linebaugh. Gen. Elec. Rev., vol. 30, no. 9, Sept. 1927, pp. 432-442, 18 figs. Tests and test equipment; various types of suspension; advantages and disadvantages of each; summary of test results.

ELECTRIC WELDING, ARC

Stellite. Arc Welding of Stellite, C. M. Rusk. Welding Engr., vol. 12, no. 8, Aug. 1927, pp. 32-33, 6 figs. Great savings are shown in cement mills where grinding rings are reclaimed at low cost and long shutdowns averted.

ENGINEERING

Sanitary, United States. Historic Review of the Development of Sanitary Engineering in the United States During the Past One Hundred and Fifty Years. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1585-1648. Symposium of seven papers dealing with developments in water works, sewerage, drainage, street cleaning, ventilation, elimination of mosquitoes.

EXCAVATION

Hydraulic Method. Earth Work by the Hydraulic Method, R. E. Miller. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1713-1719. Discusses subject from standpoint of contracting engineer, with particular reference to aid that can be derived in making estimates of cost of earth work from series of laboratory tests of samples of earth to be moved.

F

FANS

Centrifugal. Application of Dimensional Analysis to Centrifugal Fans, E. M. Fernald. Mech. Engrs., vol. 49, no. 9, Sept. 1927, pp. 1004-1005, 2 figs. A mathematical treatment.

FILTERS, SAND

Operation and Control. Operation and Control of Rapid Sand Filters, S. T. Powell. Water Works, vol. 66, no. 9, Sept. 1927, pp. 361-363. General discussion of difficulties encountered and means of overcoming them; coagulation; sedimentation basins; filter beds; air-bound filters, etc.

FILTRATION PLANTS

Water Level Recorder. Graphic Filter Water Level Recorder, C. C. Covert. Can. Engr., vol. 53, no. 8, Aug. 23, 1927, pp. 239-240. Operation of recorder for filters and reservoirs described in paper presented at Annual Convention of American Water Wks. Assn., Chicago; an aid to more efficient operation of filter plants.

FIXTURES

Drilling. Drilling and Pin Assembling Fixtures, B. J. Stern. Machy. (N.Y.), vol. 34, no. 1, Sept. 1927, pp. 53-54, 3 figs. Description of a fixture for drilling a blind hole in a casting.

FLAT PLATES

Deflection in. Soc. of Mech. Engrs.—(Japan), vol. 30, no. 123, July 1927, pp. 335-344.

FLOW OF AIR

Measurement. Air-Meter for Engine Research. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 224 and 326, 2 figs.

FLOW OF FLUIDS

Curved Pipes. Note on the Motion of Fluid in a Curved Pipe, W. R. Dean. London, Edinburgh and Dublin Philosophical Mag. & Jl. of Science, vol. 4, no. 20, July 1927, pp. 208-223, 3 figs. In this paper, steady motion of incompressible fluid through pipe of circular cross-section which is coiled in circle is considered.

FLOW OF WATER

Gates and Short Pipes. Flow of Water Through Gates and Short Pipe Sections, W. H. Holmes. West. Constr. News, vol. 2, no. 14, July 25, 1927, pp. 52-54, 10 figs. Calibration of irrigation gates.

Measurement. Precise Weir Measurements, E. W. Schoder. Am. Soc. Civ. Engrs. —Proc., vol. 53, no. 7, Sept. 1927, pp. 1395-1504. Presents results of extensive new volumetric measurements of discharge over weirs of sharp-crested (or nearly sharp) type, occupying full width of channel (that is, without end contractions).

FOUNDATIONS

Anti-Vibration. Anti-Vibrations Installations. Engineering, vol. 124, no. 3215, Aug. 26, 1927, pp. 259-261, 9 figs. Discusses three methods of treatment.

FOUNDRIES

Electric Steel. Preheating Reduces Melting Period, E. Bremer. Foundry, vol. 55, nos. 16 and 17, Aug. 15 and Sept. 1, 1927, pp. 626-630 and 674-677, 12 figs.

Steel. Steel Foundry Practice Enlarged Upon. Foundry Trade Jl., vol. 36, no. 573, Aug. 11, 1927, pp. 125-127. Discussion of a paper, The Manufacture of a Large Steel Casting, read before the Sheffield Convention by F. A. Melmoth and T. Brown.

FUELS

Changes in Use of. Impending Changes in Our Use of Fuels, A. D. Little. Mech. Eng., vol. 49, no. 9, Sept. 1927, pp. 952-954. Recent developments in the processing of coal to increase its form value, and the possibilities of extension of the gas industry.

Coal. *See Coal; Pulverized Coal.*

Research. The Fuel Research Board. Engineering, vol. 124, no. 3213, Aug. 12, 1927, pp. 193-194. Annual report which has just been issued on behalf of Fuel Research Board of Dept. of Scientific and Industrial Research, together with appended report of Dr. Lander, Director of Fuel Research.

FURNACES, HEAT TREATING

Developments in. Furnace Development in Heat Treating and Forging, W. M. Hepburn. Am. Soc. for Heat Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 14 pp., 7 figs. Scientific developments in furnace equipment, with particular reference to combustion, refractories, insulation and temperature controls; some outstanding modern gas-fired installations embodying significant developments are described.

FURNACES, INDUSTRIAL

Construction. Binding for Industrial Furnaces, A. E. Perkins. Forging—Stamping—Heat Treating, vol. 13, no. 8, Aug. 1927, pp. 329-330, 1 fig. Author gives calculations required to provide necessary strength in binding of furnaces; relation of binding to furnace life.

Heat Utilization. How Research Has Cut Cost of Heating in Industrial Furnaces, F. W. Manker. Mfg. Industries, vol. 14, no. 3, Sept. 1927, pp. 215-218, 3 figs. $37,500 saved per year in heating forging, boiler efficiency increased to 79 per cent, varnish cooking done from 30 to 75 per cent faster, scale and wasters eliminated by sheet steel normalizing.

G

GAUGES

WEAR OF. Recent Experiments Relating to the Wear of Plug Gauges, H. J. French and H. K. Herschman. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 26 pp., 11 figs.

GAS ENGINES

OPERATION. Motive-Power Installations Using Producer Gas (Les installations de force motrice au gaz pauvre), J. Brunswick. Pratique des Industries Mécaniques, vol. 10, nos. 4 and 5, July and Aug. 1927, pp. 133-138 and 190-198, 4 figs. Reviews causes of derangements in operation and gives instructions for maintenance and correct economic operation of such engines.

GEARS

EFFICIENCY, STRENGTH AND DURABILITY. The Efficiency, Strength and Durability of Spur Gears, W. H. Rasche. Eng. Experimental Station of Virginia Polytechnic Inst., no. 3, June 1927, 44 pp., 4 figs. A force-efficiency analysis of the Lewis-Webb gear-testing machine.

GOLD METALLURGY

CYANIDATION. Precipitation of Gold and Silver from Cyanide Solution on Charcoal, J. Grsos and J. W. Scott. U.S. Department of Commerce—Bur. of mines, no. 378, 1927, 72 pp., 10 figs. Investigation included making of satisfactory charcoal, and possible re-use of charcoal after it has been loaded to its ultimate capacity; methods of using charcoal and effect of impurities in solutions were also investigated; considerable attention was necessarily paid to theory of precipitation; method of testing was developed by which comparisons were possible at different stages of work; investigation also included review of pertinent literature; bibliography.

GOLD MINING

CANAOA. The Development of Gold Mining in Canada, G. E. Cole. Can. Min. & Metallurgical Bul., no. 185, Sept. 1927, pp. 1013-1150, 50 figs. History and present state of gold mining in Canada, which yields about 9 per cent of annual world output.

GRINDING

BALL-BEARING MANUFACTURE. Generate Radial Surfaces with Precision Abrasive Tools, E. Viall. Abrasive Industry, vol. 8, no. 9, Sept. 1927, pp. 275-277. 6 figs. Description of machines and methods of grinding ball-bearing races.

CENTRELESS. Centreless Grinding of Unusual Jobs, H. Rowland. Can. Machy., vol. 37, nos. 23, 24, 25 and 26, June 9, 16, 23 and 30, 1927, pp. 15-17, 16-17, 9-11 and 89-90, 20 figs. Fundamental structure of centreless grinder, and theories underlying action of regulating wheel showing how round and straight cylindrical parts are produced.

GRINDING MACHINES

SMALL PARTS. 10 in. by 18 in. Model " B " Plain Grinding Machine. Brit. Machine Tool Eng., vol. 4, no. 46, July-Aug. 1927, pp. 625-627, 4 figs.

WORM-THREAD. Automatic Worm Grinding Machine. Machy. (Lond.), vol. 30, no. 976, Aug. 25, 1927, pp. 655-656, 5 figs. Description of Pratt and Whitney automatic worm-thread grinding machine.

Automatic Worm-Thread Grinding Machine. Machy. (Lond.), vol. 30, no. 774, Aug. 11, 1927, pp. 601-602, 2 figs. A universal automatic grinding machine made by Brown & Sharpe Mfg. Co.

H

HARBOURS

LAKE MICHIGAN. Advantages of Water Transport Warrant Special Harbour. Eng. News Rec., vol. 99, no. 3, July 21, 1927, pp. 101-102, 2 figs. Buffington harbour built to handle and store bulk material for cement plant on Lake Michigan; 55-acre basin with a dredged depth of 24 ft.

HARDNESS

TESTS OF. The Application and Uses of Hardness Tests, W. Deutsch. Eng Progress, vol. 8. no. 8, Aug. 1927, pp. 216-218, 5 figs. Discussion of various types of hardness tests.

HEAT TRANSMISSION

BUILDING WALLS. Standard Test Code for Heat Transmission of Walls. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 33, no. 8, Aug. 1927, pp. 505-507 and (discussion) 508-512. Report of the Committee on Testing Insulating Materials for wall construction.

CALCULATION OF. Notes on the Calculation of Problems in Heat Transfer, J. R. Zwieki. Refrigering Engr., vol. 14, no. 3, Sept. 1927, pp. 100-103, 3 figs.

TEMPERATURE DISTRIBURION. Determining Temperature Distribution. Elecn., vol. 99, no. 2568, Aug. 19, 1927, pp. 225-226. A contribution to the evaluation of the flow of heat in isotropic media.

HEATERS

EXTENDEO SURFACE. Designing a Gravity Extended Surface Heating Unit, R. N. Trane. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 33, no. 6, June 1927, pp. 373-380, 19 figs. Steps in development of a gravity-type copper heating unit.

HEATING

INOUSTRIAL, CONTROL. Industrial Heating Control, P. H. Clark. Gen. Elec. Rev., vol. 30, no. 9, Sept. 1927, pp. 446-452, 12 figs. Working limits of industrial temperatures; thermostat control; potentiometer control; panels; overload protection; temperature limit fuses.

HEATING AND VENTILATION

GARAGES. Report of the Work of the Conference Committee on N.F.P.A., on Heating and Ventilation of Garages, O. N. Walther. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 33, no. 8, Aug. 1927, pp. 482-488.

SCHOOLS. Heating and Ventilating of Toronto Schools, J. S. Patterson. Am. Soc. of Heat & Vent. Engrs.—Jl., vol. 33, no. 9, Sept. 1927, pp. 573-576. Types of heating and ventilating equipment used in Toronto (Canada) schools.

HEATING, STEAM

CAPACITY OF RISERS. Capacity of Up-Feed Steam Heating Risers for One- and Two-Pipe Systems, F. C. Houghten and M. E. O'Connell. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 33, no. 9, Sept. 1927, pp. 545-567 and (discussion) 567-572, 26 figs. Investigation of critical velocity and its bearing on pipe sizes for steam heating systems was undertaken at the Research Laboratory of the Am. Soc. of Heat. & Vent. Engrs. early in 1922.

RADIATOR EXPOSURE. Effect of Enclosures on Radiator Performance, A. P. Kratz. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 33, no. 6, June 1927, pp. 353-364, 9 figs. Object of this particular phase of investigation was to determine effect of various types of radiator enclosures and shields on steam-condensing capacity of unenclosed radiator.

HELIUM

CANADA. Helium in Canada, R. T. Elworthy. Canada—Dept. of Mines, no. 679 1926, 64 pp., 2 figs. The following report gives a brief account of the resources, together with details of methods employed in analysis and extraction, and an outline of progress that has been made in the United States; some possible industrial uses of helium are also reviewed.

HIGHWAYS

APPLICATION OF SOIL SCIENCE TO. The First International Soil Congress and Its Message to the Highway Engineer, C. Terzaghi. Pub. Roads, vol. 8, no. 5, July 1927, pp. 89-94. Soil scientists and highway engineer's attitude toward soil; Russian method of subgrade investigation; compromise between Russian and American method desirable; highway engineers must secure assistance of soil scientists; new developments in soil physics; certain soil ingredients attack concrete.

MAINTENANCE. Federal Influence and Authority, T. H. MacDonald. Eng. News-Rec., vol. 99, no. 9, Sept. 1, 1927, pp. 340-345, 6 figs. Factors which make highway maintenance essential; traffic distribution; state and federal maintenance; future problems.

Determining Snow Removal Requirements, V. R. Burton. Eng. News-Rec., vol. 99, no. 7, Aug. 18, 1927, pp. 256-260, 8 figs. Discusses snow removal problem in Michigan; volume and character of snowfall; effect of temperature; wind effects.

Snow Removal Methods and Equipment, V. R. Burton. Eng. News-Rec., vol. 99, no. 8, Aug. 25, 1927, pp. 302-307, 6 figs. Discussion of snow removal problem in Michigan; theory and prevention of drifts.

RESEARCH. Recent Developments in Highway Research, S. S. Steinberg. Engrs. & Eng., vol. 44, no. 7, July 1927, pp. 167-168. Accidents; skidding; braking; headlighting; power required to drive automobiles on different types of roadway; effect of wind.

HYDRAULIC TURBINES

BUILDING A SPIRAL CASING. Building a Spiral Water Turbine Casing, C. E. Lester. Boiler Maker, vol. 27, no. 8, Aug. 1927, pp. 218-223, 6 figs. Methods employed at Newport News shipyard for the construction of a complicated plate layout and assembly job.

NIAGARA FALLS. Hydro-Electric Turbines in General and for Niagara in Particular, F. Nagler. West. Soc. of Engrs.—Jl., vol. 32, no. 7, Aug. 1927, pp. 233-242, 10 figs. This paper describes hydraulic end of Niagara Falls unit; it gives interesting comparisons of types of water wheels that have been used since ancient times to generate power and shows application of each; Niagara unit is largest single prime mover yet built, although excelled in capacity by some steam turbines made up of several units in tandem; it attains remarkable efficiency of 93.8 per cent or including generator it delivers more than 90 per cent of the potential energy of the water to the switchboard.

HYDRO-ELECTRIC DEVELOPMENTS

CANADA. Power Developments on Gatineau River, R. C. Howe. Can. Engr., vol. 53, no. 7, Aug. 16, 1927, pp. 217-221, 7 figs. Progress of construction at Chelsea, Farmers Rapids and Paugan Falls; storage system to regulate flow of river; water control system evolved to synchronize with peak-load requirements; conservation of water a dominating factor.

Potential 616,000 H.P. at Bridge River Development by B.C.E.R. Co. Eng. News, vol. 36, no. 17, Sept. 1, 1927, pp. 27-29, 3 figs. Two 610-h.p. Diesel engines installed for construction purposes; rock tunnel 13,200 feet long to be bored.

HYDRO-ELECTRIC PLANTS

NOVA SCOTIA. Electric Power in Digby, Nova Scotia. Elec. News, vol. 36, no. 15, Aug. 1, 1927, pp. 29-30, 2 figs. Description of 250 kv.a. hydraulic plant at Digby, Nova Scotia.

CONOWINGO. Conowingo Hydro-Electric Power Project, G. R. Strandberg. Eng. & Contracting, vol. 66, no. 8, Aug. 1927, pp. 363-367, 7 figs. Description of the project and the construction plan used in executing the work.

Operating Plans and Expected Costs of Conowingo. Elec. World, vol. 90, no. 7, Aug. 13, 1927, pp. 307-310. Plant will ultimately develop 594,000 h.p. in eleven 40,000-kv.a. generators; expected distribution of investment and method of operating under light and peak loads during low- and high-flow periods.

I

ICE PLANTS

DIESEL-ENGINE DRIVE. Diesel Engine Drive for Ice Plants, R. L. Howes. Refrig. World, vol. 62, no. 9, Sept. 1927. pp. 18-20. Studies power problem of ice plant from point of view of different types of Diesel engines, type of drives available, h.p. requirements and probable cost of operation.

COST ACCOUNTING. *See Cost Accounting.*

DEPRECIATION. Principles of Depreciation, J. J. Berliner. Paper Industry, vol. 9, no. 5, Aug. 1927, pp. 779-782. Their application in determining when equipment should be scrapped.

MAINTENANCE. Some Problems of the Factory Maintenance Engineer, L. H. Hopkins. Belting, vol. 30, nos. 3 and 4, Mar. and Apr. 1927, pp. 15-17 and 24-26, 2 figs. Systematic inspection of equipment and full co-operation between maintenance and manufacturing departments essential. Apr.: Definite oiling schedules and thorough cleaning at proper intervals.

MEASURING DIRECT LABOUR. Predetermined Costs Provide an Effective Means for Measuring Direct Labour, F. A. Hayes. Textile World, vol. 72, no. 9, Aug. 27, 1927, pp. 49-55. Absorption of overhead important; effect of disposition of unearned portion on price and inventory.

SCIENTIFIC METHOD IN. The Scientific Method in Industry, G. P. Cole. Eng. Jl., vol. 10, no. 9, Sept. 1927, pp. 415-420. Its necessity at present time and some examples of its application; states that there is nothing new in scientific method, but that it is simply case of planning ahead, devoting sufficient thought to problem at hand and utilizing every possible source of information.

INSULATORS

MEASUREMENT OF VOLTAGE DISTRIBUTION. Voltage Distribution Over Insulators, F. E. Reeves. Elec. World, vol. 90, no. 8, Aug. 20, 1927, pp. 357-361, 10 figs. Neontube potentiometer employed for studying potentials; various steps in investigation and difficulties overcome; potential distribution at sub-corona voltages; benefits of shielding.

IRON

DIRECT PRODUCTION. The Direct Production of Pure Iron, P. Longmuir. Am. Electrochem. Soc.—Advance Paper, for meeting, Apr. 28-30, 1927, pp. 695-705. Author's experience is such as to lead him to pessimistic rather than optimistic view as to commercial possibilities of direct reduction; Thomas Rowland's process, however, offers decided advantages over other older processes; primary advantage is in direction of recovery of whole of iron present in ore in state of metallic purity; main stages of Rowland's process are: distillation of coal; preliminary reduction of iron ore; complete reduction of iron ore; magnetic separation of pure metallic iron; revival of spent gases; iron produced forms excellent foundation material for production of very highest class of straight carbon and alloy steels.

INTERNAL-COMBUSTION ENGINES

EXHAUST-HEAT RECOVERY. The Recovery and Utilization of Heat from the Exhaust Gases of Internal-Combustion Marine Engines, T. Clarkson. Mech. World, vol. 82, no. 2119, Aug. 12, 1927, pp. 115-116. Boilers for use of waste heat, and problems in waste heat recovery. Paper read before Institute of Marine Engineers, Inc.

Steam Cooling. The Application of Steam Cooling to Internal-Combustion Engines, H. T. Davey. Mech. World, vol. 82, no. 2117, July 29, 1927, p. 78, 1 fig. Short note explaining system and its advantages.
See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines.

IRON

Armco. Armco Ingot Iron, R. L. Kenyon. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 59 pp., 36 figs.
Microstructure. Some Unusual Microstructures in Iron, F. S. Tritton. Metallurgist (Supp. to Engineer), June 1927, pp. 88-90, 6 figs. Unusual microstructures described have been observed in specimens of iron during course of metallurgical research in a modern laboratory, and illustrate that iron still exhibits some phenomena that are not well known or understood.

IRON AND STEEL

Bend Test. A Critical Study of the Bend Test as Applied to Iron and Steel, A. B. Kinzel. Am. Soc. for Steel Treat.—Advance Paper, no. 8, for mtg. Sept. 19 to 23, 1927, 15 pp., 10 figs.
Gases in. Gases in Molten Iron and Steel. Metallurgist (Supp to Engineer), June 1927, p. 87. Method of determining gas contained in a known volume of molten iron or steel, intended primarily for work on a small laboratory scale; masses of metal used varying from 150 to 90 grams.

IRON CASTINGS

Diesel-Engine. Castings for Diesel Engines, H. Matsuura. Foundry Trade Jl., vol. 36, no. 575, Aug. 25, 1927, pp. 175-177. Report of investigation carried out at Niigata Engineering Works, Japan; strength of cast iron at elevated temperatures; wearing qualities of cast iron; properties of high manganese semi-steel.
Pulleys, Cracking of. Why Do Pulley Arms Crack? H. N. Tuttle. Foundry, vol. 55, no. 17, Sept. 1, 1927, pp. 695-696, 8 figs. Uneven cooling speed sets up contraction strains that cause distortion; remedies suggested where due to design, melting or moulding practice.
Scrapping. Scrapping a Large Grey Iron Casting. Foundry Trade Jl., vol. 36, no. 571, July 28, 1927, p. 81. Top portion of large press, weighing 17 tons, successfully scrapped in 6½ hours.

IRON ALLOYS

Manganese. Alloys of Iron and Manganese Containing Low Carbon, R. Hadfield. Foundry Trade Jl., vol. 36, no. 18, Aug. 18, 1927, pp. 157-158. Comparison of two types of alloys of iron and manganese, one with carbon varying from about 0.50 to 1.20 per cent and the other with little or no carbon, 0.08 to 0.20 per cent.

K

KEROSENE

Carburetion of. Carburetion of Kerosene, C. S. Kegerreis, H. A. Huebotter and M. J. Zucrow. Purdue Univ.—Eng. Departments Bul., vol. 11, no. 6, Mar. 1927, 38 pp., 32 figs.

L

LABORATORIES

Aerodynamic. Aero-Dynamics Laboratory at Stanford University, R. H. McDonnell. West. Constr. News, vol. 2, no. 14, July 25, 1927, pp. 50-51, 1 fig. A brief description of Guggenheim Aerodynamic Laboratory, Stanford University.
Hydraulic. Hydraulic Laboratories in U.S.A. Eng. Foundation, no. 5, June 1922, 84 pp. A list, with notes on equipment and work done.

LACQUER

Surfacers. Lacquer Surfacers, F. M. Beegle and C. M. Simmons. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 971-972.

LATHES

Capstan. A New Capstan Lathe. Brit. Machine Tool Eng., vol. 4, no. 46, July-Aug. 1927, pp. 628-631, 5 figs. Single pulley all-geared type of lathe, with centre height of 7 in., capable of performing much wider range of work than is possible on machines of 6½ in. centre height.
Nut Facing. Nut Facing Lathes. Brit. Machine Tool Eng., vol. 4, no. 46, July-Aug. 1927, pp. 633-634, 2 figs. Special machine for making one face of nut perfectly square to thread; built in two sizes, for nuts having from ½ to 1½ in. thread diameter and for nuts from from 1½ to 3½ in. diameter.

LEAD

Canada. Lead and Zinc in Canada, T. W. Bingay and F. J. Alcock. Can. Min. & Met. Bul., no. 184, Aug. 1927, pp. 920-943, 13 figs. History and geology of lead and zinc in Canada; paper before Vancouver meeting of Empire Mining and Metallurgical Congress, Sept. 14, 1927.

LIGHTING

Flood. Flood Lighting. AEG Progress, vol. 3, no. 7, July 1927, pp. 199-203, 17 figs. Applications of flood lighting; lamps and fixtures.
Streets. A Comparison of Street Light Control Methods, L. W. Guin. Elec. Jl., vol. 24, no. 9, Sept. 1927, pp. 444-445. Discusses various methods for both series and multiple control.
The Problems of Public Lighting by Electricity, H. T. Harrison. Instn. Elec. Engrs.—Jl., vol. 65, no. 368, Aug. 1927, pp. 752-761, 4 figs. It is proposed that light sources should be centrally suspended at frequent intervals by means of span wires, which, in order to reduce cost and to simplify control and maintenance, should support conductors; various examples of overhead suspension and of usual method of supporting by means of columns are cited, with object of comparing these with suggested solution of problem; it is pointed out that modern gas-filled electric lamps, due to their light weight and little attention required, are specially suited to suggested methods of support, and that when combined with necessary conductors whole overhead equipment is inexpensive and not unsightly.

LOCOMOTIVES

Internal-Combustion vs. Steam. Economics of Internal-Combustion Locomotives, A. H. Shelest. Eng. News (Russian), no. 7, 1927, pp. 285-288, 3 figs. Analyzes fixed charges and operating costs of large steam and internal-combustion locomotives, assuming for latter thermal efficiency about 5 times greater than for first, and concludes that limiting cost of one combustion locomotive must not exceed cost of two steam locomotives.
Northern Type. Building the Empire's Biggest Engine. Can. Machy. & Mfg. News, vol. 38, no. 14, Sept. 1, 1927, pp. 15-18, 4 figs. New series of locomotives under construction in Montreal and Kingston for Can. Nat. Rys. embody many special features and surpass in weight, length and power any engine yet constructed in the Dominion.
Smokebox Regulator. A New Type Smokebox Regulator for Superheater Locomotives. Ry. Gazette, vol. 47, no. 11, Sept. 9, 1927, pp. 308-309. Arrangement which on grounds of ready accessibility and low maintenance costs makes it especially attractive to locomotive engineers.

LUBRICANTS

Cutting Oils. Cutting and Soluble Oils, H. L. Kauffman. Am. Mach., vol. 67, no. 9, Sept. 1, 1927, pp. 343-344. Soluble compounds in paste form are useful where it is difficult to use liquid lubricants; care and handling of compounds.

LUBRICATION

Ball Bearings. High-Speed Ball-Bearing Lubrication, S. Madsen. Wood-Worker, vol. 46, no. 6, Aug. 1927, pp. 41-42. Particularly as applied to wood-working machinery.

M

MACHINE DESIGN

Metal Industries. Machine Design in the Metal Industries, L. T. Rutledge. Can. Machy. & Mfg. News, vol. 38, no. 13, Aug. 25, 1927, pp. 22-23. A definition and a sketch of the history, progress, methods and aims of machine design, as well as a discussion of the accuracy essential in proportioning the several members of a machine. See also no. 9, Sept. 1, 1927, pp. 18-19.

MACHINE-TOOL INDUSTRY

Historical Review. The American Machine Tool Industry, E. Oberg. Machy. (N.Y.), vol. 34, no. 1, Sept. 1927, pp. 43-47, 2 figs. A brief historical review of the development of a basic industry.

MACHINE TOOLS

Accuracy in Manufacture. Gas Furnaces and Instrument Control Produce Quality Tools, F. W. England. Mfg. Industries, vol. 14, no. 3, Sept. 1927, p. 175, 4 figs. Development of specialized machinery and elaborate methods for producing and maintaining accuracy in manufacture, and instruments for testing this accuracy, with special reference to products of Illinois Tool Works.
Cost-Reducing Aspects. Modern Machine Tools. Machy. (Lond.), vol. 29, no. 753 and 754, Mar. 17 and 24, 1927, pp. 761-775 and 801-804, 45 figs.
Shipyard. Modern Shipyard Machinery, F. Puppe. Eng. Progress, vol. 8, no. 8, Aug. 1927, pp. 205-208, 10 figs. Plate straightening machines; plate shears; revolving horizontal and vertical hole punching machines; three-roll plate bending machines for medium-sized ships.

MACHINING METHODS

Spiral-Gear Bracket. Machining a Spiral Gear Bracket. Mech. World, vol. 82, no. 120, Aug. 19, 1927, p. 132, 4 figs. The operations and jigs required for the machining of a spiral-gear bracket in quantity.
Steam Condensers. Machine Work in a Southern Plant. West. Machy. World, vol. 18, no. 8, Aug. 1927, pp. 388-390, 5 figs. Some machine work on steam condensers.

MATERIALS HANDLING

Cost Reduction. Cutting Your Handling Costs, G. E. Hagemann. Mfg. Industries, vol. 14, no. 1, July 1927, pp. 19-22, 6 figs. Summarizes factors governing materials handling in individual plants, large or small, new or old, to arrange useful and practical information and data gathered from many sources so that it can be logically analyzed and clearly understood, and supplies facts and figures from experience that can be directly applied to reorganize methods and effect big economies.
Getting the Most Out of the Plant Material Handling System, G. E. Hagemann. Mfg. Industries, vol. 14, no. 3, Sept. 1927, pp. 207-210, 6 figs. Doubling use factor and return on investment; cuts cost of production.
Foundries. What Mechanical Handling Means to Foundry Profits, P. Cuno. Indus. Mgmt. (N.Y.), vol. 74, no. 2, Aug. 1927, pp. 74-79, 11 figs. Savings and increased production accomplished by use of materials handling equipment.
Production Factor. Handling a Factor in Production, F. L. Eidmann. Can. Machy. & Mfg. News, vol. 38, nos. 13 and 14, Aug. 25 and Sept. 1, 1927, pp. 21-22 and p. 22. Materials handling, which few years ago was not regarded as much of a factor in production, has now reached the stage where it is one of the primary considerations in plant design.

MECHANISMS

Automatic Coil Winder. Automatic Coil Winding Machines. Machy. (Lond.), vol. 30, no. 776, Aug. 25, 1927, pp. 649-651, 2 figs. Description of a coil winding mechanism which has automatic feature of stopping for taps, at end of coil, if wire should break, and when wire supply spool is empty.
Relieving Mechanism. Formed Cutter Relieving Mechanism, H. C. Town. Machy. (N.Y.), vol. 34, no. 1, Sept. 1927, pp. 62-64, 3 figs. The relieving mechanism described operates by moving the cutter toward and away from the relieving tool, the latter remaining stationary except for a slight feeding movement after each cutter revolution.

METALLOGRAPHY

Polishing and Etching. A Metallographic Polishing Machine, O. E. Romig and J. C. Whetzel. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 2, Aug. 1927, pp. 235-238, 1 fig.
Polishing and Etching Lead, Tin and Some of Their Alloys for Microscopic Examination, J. R. Vilella and D. Beregekoff. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 1049-1052, 16 figs.

METALS

Machinability. Machinability of Metals, O. W. Boston. Am. Soc. for Steel Treat.—Advance Paper, no. 6, for mtg. Sept. 19 to 23, 1927, 39 pp., 28 figs. This paper gives outline of various methods which are being used to designate machinability of metals, and gives under heading of each method outline of work done by various authors as published in few outstanding papers on subject.
Wear Testing of. Wear Testing of Metals, H. J. French. Engineering, vol. 124, no. 3215, Aug. 26, 1927, pp. 279-280. Paper presented at the annual meeting of the Am. Soc. for Testing Materials, French Lick, Ind., U.S.A., June 20-24, 1927. Abridged.

MICA

Uses of. Mica and Its Uses, G. V. Hobson. Chem. Eng. & Min. Rev., vol. 19, no. 226, July 5, 1927, pp. 367-369. Abstract of a paper before Institution of Mining and Metallurgy, London, March 17, 1927.

MINE VENTILATION

Measuring Air. Measuring Mine Air, A. C. Callen and C. M. Smith. Queensland Government Min. Jl., vol. 28, no. 326, July 15, 1927, pp. 258-259, 4 figs. What ventilation research has revealed; summary of conclusions arrived at; effect of normal disturbances on mine atmosphere.

MINING

History of. World's First Organized Mining, S. H. Ball. Queensland Government Min. Jl., vol. 28, no. 326, July 15, 1927, pp. 268-270. Operations of the Ancient Egyptians; how the Pharaohs delved for turquoise; an industry of 5,000 years ago.

MOTOR BUSES

Electric Drive. The Electric Drive as a Motor-Coach Transmission, C. Froesch. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 268-276, 14 figs. Engineering factors involved in adaptation of electric drive to motor buses; advantages and disadvantages discussed.

MOULDING METHODS

RUNNERS, RISERS AND GATES. Runners, Risers and Gates, J. Butterworth. Mech. World, vol. 82, no. 2120 and 2121, Aug. 19 and 26, 1927, pp. 137-138 and 148. Round or square runners; applications to different castings.

MOTOR TRUCKS

VIBRATIONS CAUSED BY. Earth Vibrations Caused by Motor Vehicles, E. Essers and T. Kappes. Eng. Progress, vol. 8, no. 8, Aug. 1927, pp. 221-222, 4 figs. A communication from the Laboratory for Automotive Engineering and the Seismological Institute of the Technical University at Aachen.

O

OIL ENGINES

ICE PLANTS. Oil Engine Drive for Ice-Making Plants, R. C. Wallace. Cold Storage, vol. 30, no. 353, Aug. 18, 1927, pp. 261-262. Operating costs composed with steam and electricity.

INJECTION VALVES. Factors in the Design of Centrifugal Type Injection Valves for Oil Engines, W. F. Joachim and E. G. Beardsley. Nat. Advisory Committee for Aeronautics, no. 268, Aug. 1927, 15 pp., 22 figs. Research undertaken at the Langley Memorial Aeronautical Laboratory at Langley Field, Va.

OIL INDUSTRY

CANADA. Putting Canada on the Oil Map, J. Ness. Petroleum Times, vol. 18, no. 450, Aug. 27, 1927, pp. 389-392, 2 figs. Summarizes development of oil industry in Canada during recent years; operations of Imperial Oil, Ltd.

OIL WELLS

CANADA. Petroleum in Canada. Petroleum Times, vol. 18, nos. 448 and 449, Aug. 13 and 20, 1927, pp. 297-298 and 351-354, 2 figs. An informative historical review.

ORDNANCE

ANTI-FRICTION BEARINGS. Anti-Friction Bearings in Ordnance Work, F. Brauer. Mech. Eng., vol. 49, no. 9, Sept. 1927, pp. 959-965, 14 figs. Rapid and easy manipulation of heavy ordnance made possible by the use of ball and roller bearings; some designs for heavy-load conditions.

OXY-ACETYLENE WELDING

AIRPLANE FUSELAGE. Gas Welded Fuselage Construction, N. Damours. Welding Engr., vol. 12, no. 8, Aug. 1927, pp. 34-36, 6 figs. Strong joints obtained with oxy-acetylene torch act as a protection to passengers when engine trouble develops.

P

PAINTS

ALUMINUM. Protecting Wood with Aluminum Paint, J. D. Edwards and R. I. Wray. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 975-977.

TESTING DURABILITY OF. A Principle for Testing the Durability of Paints as Protective Coatings for Wood, F. L. Browne. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 982-985, 3 figs. Purpose of this paper is to set forth the basic principle of a technic for measuring, independently of the personal bias of the operator, the degree of protection afforded by paint coatings against the weathering of wood and the change in their protective power as the coatings themselves deteriorate during exposure.

PAVEMENTS

BITUMINOUS PENETRATION. Bituminous Penetration Pavement, E. C. Welden. Roads & Streets, vol. 67, no. 8, Aug. 1927, pp. 366-368. Design features and methods of construction discussed in paper presented at annual convention of American Association of State Highway Officials.

CONCRETE. New Developments in Concrete Pavement Construction, J. E. Jellick. West. Constr. News, vol. 2, no. 16, Aug. 25, 1927, pp. 42-43, 1 fig. Proportioning concrete aggregates by weight measurement, mixture design, involving use of three sizes of coarse aggregate and building of weakened plane joints, featured construction of 3.2 miles of 30-ft. wide cement concrete highway pavement recently completed as Whittier boulevard in Los Angeles county.

PAVEMENTS, ASPHALT

FOUNDATIONS FOR. Foundations for Asphalt Surfaces, K. C. Johnson. S. African Engr., vol. 17, no. 110, June 1927, pp. 21-23, 2 figs. Flexible and rigid types; their advantages and failings.

PIPE, CONCRETE

DRAINAGE. Huge Drainage Projects Use Precast and Monolithic Concrete Pipe. Concrete, vol. 31, no. 3, Sept. 1927, pp. 42-44, 6 figs. $14,000,000 invested in drainage projects in Detroit's metropolitan area; several projects under way; precast concrete pipe, monolithic concrete pipe and concrete-lined tunnels placed; construction methods.

PIPE LINES

CREEP DURING CONSTRUCTION. Movement of Mokelumne Pipe Line During Construction. Eng. News-Rec., vol. 99, no. 5, Aug. 4, 1927, pp. 184-187, 6 figs. Experimental study of creep due to temperature changes; analysis of resulting stresses in pipe; some unrecognized sources of pipe stress.

JOINTS. Designs for Joints in Large Pipe on the Ocean Bottom. Eng. News-Rec., vol. 99, no. 8, Aug. 25, 1927, pp. 294-297, 6 figs. Suggestions for improvements that have arisen from experience with Pacific Ocean outfall sewers subject to severe wave action.

STEEL, OX-WELDING. Ox-Welding of Steel Pipe Lines, S. W. Miller. Can. Machy. & Mfg. News, vol. 38, no. 14, Sept. 1, 1927, pp. 25-27. While some of earliest welding in production was the joining of steel and wrought iron pipe, such use of this tool has grown tremendously in recent years, as the ox-welded line presents economies hitherto unavailable.

PIPES, STEEL

WELDED. Suggests Annealing for Welded Pipe, J. L. Avis. Iron Age, vol. 120, no. 8, Aug. 25, 1927, pp. 474-476, 9 figs. Tests on water supply pipe show weakness in zone alongside joint, having grain coarsened by welding heat; treatment of plates in manufacture.

POWER PLANTS

DIESEL-ENGINE STANDBY. Solving the Peak Load Problem. Can. Engr., vol. 53, no. 9, Aug. 30, 1927, pp. 261-262, 3 figs. Diesel engines for standby purposes in water works and electric lighting plants; itemized cost of operating 500-h.p. and 1,000-h.p. Diesel units; four-cycle engines of solid injection type.

PRESSWORK

INCREASING OUTPUT. Increasing Output with the Power Press, D. M. Duncan. Can. Machy. & Mfg. News, vol. 38, no. 7, Aug. 18, 1927, pp. 13-16, 5 figs. More common types of power presses are discussed in relation to mass production of sheet-metal parts, including importance of efficiency of dies and suitability of materials.

PULVERIZED COAL

USE IN PLATE MILLS. Powdered Coal for Plate Mills, R. H. Irons. Iron Age, vol. 120, no. 8, Aug. 25, 1927, pp. 469-472, 5 figs. Transport line 1,200 ft. long; substantial reduction in heating costs for varying types of furnaces.

PUMPING STATIONS

TYPES FOR THE FUTURE. Future Pumping Stations—What Type, A. L. Mullergren. Water Wks. Eng., vol. 80, no. 17, Aug. 17, 1927, pp. 1189-1190 and 1214. Tendency to change in design; influence of steam turbine on the larger station; electricity will be used largely in smaller units.

PUMPS

AIR-LIFT. The Design of Air Lifts for Water, A. L. Egan. S. African Min. & Eng. Jl., vol. 37, no. 1841 and 1845, Jan. 8 and Feb. 5, 1927, pp. 521-523 and 623-624, 4 figs. Design of air lift to pump 700,000 gal. per hour from depth of 225 ft. at altitude of 4,000 ft.

TANGENTIAL. Use and Production of Tangential Pumps, D. M. Duncan. Power House, vol. 21, no. 17, Sept. 5, 1927, pp. 19-20, 3 figs. Fields of reciprocating and centrifugal pumps are compared and intermediate position held by tangential pump indicated in handling small volumes at high pressure.

PUMPS, CENTRIFUGAL

AUTOMATIC STARTING. Automatic Starting of Centrifugal Pumps, C. N. McDavitt. Power, vol. 66, no. 8, Aug. 23, 1927, pp. 274-277, 4 figs. A system for the automatic priming and starting of centrifugal pumps that allows them to be operated safely without an attendant, when located above the intake water level.

PYROMETRY

THERMOCOUPLES. The Measurement of High Temperatures by Thermocouples. Metallurgist (Supp. to Engr.), Aug. 1927, pp. 119-121. From an article by Wenzl and Morawe in Stahl u. Eisen, May 26, 1927, p. 867, and one by Dr. W. Rohn in Zeit. für Metallkunde, Apr. 1927, p. 138.

R

RADIO COMMUNICATION

AMPLIFICATION. Amplification in Radio Work. Elec. Times, no. 72, no. 1870, Aug. 25, 1927, pp. 220-222, 3 figs. Power and voltage amplification; high- and low-frequency amplification.

MEASUREMENT OF RADIO FREQUENCY AMPLIFICATION. Measurements of Radio Frequency Amplification, S. Harris. Inst. of Radio Engrs.—Proc., vol. 15, no. 7, July 1927, pp. 641-648, 6 figs. Advantages of method described in this paper may be summarized as follows: Measurements are independent of values of input and output voltages; measurements are made on stage in question while actually in radio receiver, under actual operating conditions; no connections are made to stage in question for purposes of measurement, excepting switch for cutting this stage in and out of amplifier; no special apparatus is required for making measurements other than that usually found in radio laboratories.

RAILS

FAILURES OF. A Diagnosis of Rail Failures, T. H. Symington. Ry. Age, vol. 83, no. 9, Aug. 27, 1927, pp. 383-385, 2 figs. Freight-car truck springs going solid on both curves and straight track suggested as a cause.

HAIR CRACKS IN. Hair Cracks in Steel Rails, J. H. Whiteley. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 2, Aug. 1927, pp. 208-215 and (discussion) 215-220 and 234, 13 figs. This paper sets forth various tests made to detect internal flaws or defects in steel rails frequently described as hair cracks; two methods were employed, magnetization and treatment with dust in kerosene, and effect of reagent; chief features of interest which were revealed by microscopic examination are enumerated.

NEWS SECTION. The Reading Adopts a New Rail Section, J. C. Wrenshall. Ry. Eng. & Maintenance, vol. 23. no. 9, Sept. 1927, pp. 369-371, 7 figs. Modified head with head-free joints shows marked advantages over common pattern.

RAILWAYS

FLOODS, DAMAGE BY. What the Flood Did to the Railways. Ry. Age, vol. 83, no. 12, Sept. 17, 1927, pp. 511-515. Data collected by Am. Ry. Eng. Assn. show damage to railways by Mississippi flood in 1927; protective measures; traffic interruptions.

RAILWAY ELECTRIFICATION

GREAT NORTHERN RAILWAY. Electrification on the Great Northern. Pub. Service Mgmt., vol. 43, no. 3, Sept. 1927, pp. 84-86, 2 figs. New motive power supplanting steam now under way will work great transformations in the West; longest tunnel in America through Cascades.

RAILWAY OPERATION

COST ACCOUNTING. Cost Accounting and the Operation Expense Classification, C. E. Parks. Ry. Age, vol. 72, no. 8, Aug. 20, 1927, pp. 339-341. Defines cost accounting, groups costs, gives results of cost accounting and discusses the elements of cost in railway operations.

TRACK CIRCUITS. Influence of Bonded Rail Resistance on Track Circuit Safety, J. B. Weigel. Ry. Signaling, vol. 20, no. 9, Sept. 1927, pp. 341-347, 10 figs. Study of effect of welded bonds on train shunt and broken rail protection using curves to illustrate graphically features of track circuit operation.

RAILWAY SHOPS

CRANES. Alternating Current for Cranes and Turntables. Ry. Elec. Engr., vol. 18, no. 9, Sept. 1927, pp. 277-281. An installation of a.c. cranes which have now long given dependable service on an eastern railroad provides dependable operation with low maintenance; 24 man-hours per month cares for 5 shop cranes.

MACHINE TOOLS. Some Railroad Shop Tools. West. Machy. World, vol. 18, no. 8, Aug. 1927, pp. 380-382, 6 figs. Boring mill and planer operations on locomotive parts such as connecting rods, shoes and wedges, bearings, etc.

RAILWAY SIGNALLING

AUTOMATIC TRAIN CONTROL. Automatic Train Control, G. E. Ellis. Pacific Ry. Club—Proc., vol. 11, no. 4, July 1927, pp. 3-36. Development of train control; plain stop and speed control; cab signals; specifications and requirements for automatic train-stop or train-control devices.

RAILWAY TRACK

MAINTENANCE. Renewal of Permanent Way, A. W. Bretland. Instn. Civ. Engrs. of Ireland—Trans., vol. 52, 1927, pp. 83-99, 7 figs. Brief description of new method of replacing railway track which, except for opening out and packing of track, and setting down and taking up of assembled track by power, concentrates all work formerly done on line in central depot equipped with electric power, and work is done under shop conditions.

TIES. Urges Broad Study of Steel Ties. Iron Age, vol. 120, no. 9, Sept. 1, 1927, pp. 559-560. Large outlet for steel in the early making, writer contends, if question is tackled by industry properly as sales-engineering-research job.

RAINFALL

RUN-OFF. Rainfall and Run-Off, E. G. Marriott. Eng. Jl., vol. 10, no. 9, Sept. 1927, pp. 421-426, 12 figs. Consideration of their relation with view to estimating discharge of streams from records of precipitation.

REFRACTORIES

PROPERTIES AND REQUIREMENTS. The Important Properties and Requirements of Some Special Refractories, M. F. Beecher. Am. Soc. for Steel Treat.—Preprint for 9th Annual Convention, Sept. 19-23, 1927, 12 pp., 2 figs. Author points out how fused alumina, silicon carbide and combinations of silica and alumina as now manufactured offer properties which are superior to those of clay refractories which are so extensively used.

REFRIGERATING MACHINES

FRENCH. The Refrigerating Industry (L'Industrie frigorifique), R. Billardson. Comptes Rendu des Travaux de la Société des Ingenieurs Civils de France—Memoires, vol. 80, nos. 3 and 4, Mar.-Apr. 1927, pp. 457-528, 23 figs.

GAS. Refrigeration by Direct Application of Heat, H. E. Keeler. Gas Industry, vol. 21, no. 8, Aug. 1927, pp. 275-279. Description of the principles of the household refrigerating machine operated by gas.

LUBRICATION. Lubrication of Refrigerating Machinery, R. Haskell. Refrig. World, vol. 62. no. 8, Aug. 1927, pp. 23-25. Paper presented by author before New York Chapter No. 2, National Association of Practical Refrigerating Engineers.

REFRIGERATING PLANTS

ELECTRICALLY DRIVEN. Electrically Driven Refrigerating Plants. Electricity, vol. 41, no. 1919, Aug. 19, 1927, pp. 581-582. Types of motors used.

REFRIGERATION

PIPING IN ICE TANKS. Amount of 1¼-Inch Piping for Ice Tanks, W. H. Motz. Refrigeration, vol. 42, no. 2, Aug. 1927, pp. 46-47, 2 figs. Effects of heat transfer rates, brine temperatures and ammonia temperatures, together with initial water temperature; data shown by a graphical chart; high heat-transfer rates obtained in new arrangement.

REFRIGERATORS

HOUSEHOLD. Specifications for Household Refrigerators. Ice & Refrigeration, vol. 73, no. 3, Sept. 1927, pp. 137-139. Tentative general suggestions and specifications covering design and construction of refrigerators; main points to consider; the ice compartment most important; ice compartment ratio; insulation; air circulation, sanitary exterior and interior, material and workmanship, etc.

ROAD CONSTRUCTION

UNITED STATES. The History and Development of Road Building in the United States. T. H. MacDonald. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1545-1570. Traces developments in road construction since Colonial days; types of roads, state and federal aid, highway research, etc.

ROADS

CONSTRUCTION. Roads and Road Construction, J. A. Ryan. Instn. Civ. Engrs. of Ireland—Trans., vol. 52, 1927, pp. 62-82. Water and tar-bound macadam; Trinidad asphalt macadam; bitumin grouted roadway; cement grouted macadam.

NATIONAL DEFENCE AND. Road Development for National Defence, E. K. Smith. Municipal & County Eng., vol. 73, no. 1, July 1927, pp. 40-44. Roads from a military point of view; war transportation experiences; Federal Aid Act; development of arteries into cities.

SURFACES. Improved Roads of Low Cost, C. N. Conner. Municipal & County Eng., vol. 73, no. 1, July 1927, pp. 11-18. From progress report presented at 6th annual meeting of the Highway Research Board. Object of investigation is to collect, correlate and present information in order that conclusions may be drawn and comparisons made on types, costs, traffic capacity and suitability of intermediate type road surfaces under varying conditions of soil and climate.

ROLLING MILLS

ROD. Rod Rolling and Wire Drawing, J. P. Bedson and J. S. G. Primrose. West of Scotland Iron & Steel Inst.—Jl., vol. 34, no. 4, Feb. 1927, pp. 52-58 and (discussion) 58-62, 8 figs. Historical; modern methods; layout of plant; continuous rod mills; cleaning; annealing; patenting; galvanizing; wire drawing; testing.

THIN SHEET. Rolling Thin Sheets, W. Krämer. Iron & Coal Trades Rev., vol. 115, nos. 3099, 3100, 3101 and 3102, July 22, 29, Aug. 5 and 12, 1927, pp. 126-127, 164-165, 200-201 and 230-231, 32 figs. Notes on Continental practice, giving information concerning existing plants and processes, and touching upon some important innovations during recent years. Offers suggestions for further improvements. Notes on Continental practice.

RUBBER

USE AS ENGINEERING MATERIAL. Rubber as a Material for Mechanical Engineering, W. A. Gibbons. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 262-264, 4 figs. Some of the fundamental mechanical and elastic properties of rubber are discussed briefly in comparison with those of steel in hope that, having a better understanding of them, engineers will increasingly consider rubber as a desirable material that is suitable for constructional purposes because of these primary mechanical properties.

STRENGTH OF. Influence of Temperature on the Tensile Strength of Reclaimed Rubber, H. F. Palmer. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 1030-1033, 6 figs. Effect of the temperature of the test strips and surrounding atmosphere during test upon resulting tensile of vulcanized reclaimed rubber mixtures is quite marked; tensile, stress and elongation decrease with rise in temperature.

S

SAND

PLANTS. Design of Sand and Gravel Plants, F. M. Welch. Can. Engr., vol. 53, no. 8, Aug. 23, 1927, pp. 246-248. Some of more recent developments in modern practice described in paper presented at Annual Convention of National Sand and Gravel Assn.; types of feeders; location of crushers; washing and screening.

TECHNOLOGY AND USES. Technology and Uses of Silica and Sand, W. M. Weigel. U.S. Department of Commerce—Bur. of Mines, no. 266, 1927, 199 pp., 50 figs. Occurrence; prospecting and examination; mining methods; preparation for market; uses; market and prices.

SAND, MOULDING

SYNTHETIC. Advocates Synthetic Sand, F. C. Scheiber. Foundry, vol. 55, no. 15, Aug. 1, 1927, pp. 612-613. Malleable foundry finds used core sand excellent basis for blended moulding mixtures; glycerine preserves moisture.

SAWS

METAL-CUTTING. Development of High-Speed Steel Hack Saws or Cutting Off Saws, H. B. Allen Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 11 pp., 1 fig.

SEWAGE

ORGANIC MATTER IN. Estimation of Organic Matter in Sewage and Effluent, W. E. Abbott. Indus. & Eng. Chem., vol. 19, no. 8, Aug. 1927, pp. 919-921. Modification of Adeney's acid dichromate method.

SEWAGE DISPOSAL

ACTIVATED SLUDGE PROCESS. Sewage Purification and Disposal, with Special Reference to the Activated Sludge Process, R. Marsh. Jr. Instn. Engrs., vol. 37, part 10, July 1927, pp. 488-524, 14 figs. General description and review of progress; read before Jr. Instn. Engrs., Manchester, Mar. 21, 1927.

CHLORINATION. Schenectady Sewage Chlorination Studies, 1926-27, M. M. Cohn. Eng. News-Rec., vol. 99, no. 6, Aug. 11, 1927, pp. 229-231. Plant-scale application of chlorine to Imhoff tanks and trickling filters results in improvement in operation and partial control of psychoda.

GREAT BRITAIN. Sewage Disposal in Great Britain, J. D. Watson. Water Wks., vol. 66, no. 9, Sept. 1927, pp. 367-370. Survey of recent developments and practices in Great Britain; purification by dilution, land irrigation, contact beds, percolating filters, activated sludge; standards of purity; treatment of storm water.

RECENT PROGRESS IN. Recent Progress in Sewage Disposal and Stream Pollution Problems, I. W. Mendelsohn. Municipal & County Eng., vol. 73, no. 1, July 1927, pp. 24-31. Co-operation between governmental agencies and private industry; recognition of joint need of sewage treatment and water purification on certain bodies of water; improvement in status of sewage plant operators; and importance of pure research in stream pollution.

SEWERS

CONCRETE, REPAIRS. Repairing Concrete Sewer, Regina, Sask., J. E. Schaeffer. Can. Engr., vol. 53, no. 9, Aug. 30, 1927, pp. 253-254, 4 figs. Acid effluent from oil refinery corrodes invert of storm sewer on Seventh Avenue, Regina; sewer ranges from 54 to 72 in. diameter; bottom of sewer relined with vitrified clay liners; work undertaken in cold weather; precautions taken to protect the mortar.

SHAFTS

TORSIONAL STRENGTH OF. Torsional Strength of Splined Shafts. Soc. of Automotive Engrs.—Jl., vol. 21, no. 3, Sept. 1927, pp. 222-223, 1 fig. Stresses at inner corners of the keyseat are expressed as ratios of the maximum stresses produced by the same torsional moment in two ordinary tubular shafts with 5.8-in. bore and diameters of 8- and 10-in., respectively; outstanding deduction from this research is that a 0.35-in. radius fillet is required to make the 10-in. diameter splined shaft as strong as a hollow circular shaft of 8-in. diameter.

SIGNALLING

TRAFFIC. Traffic Signalling in Cleveland, E. J. Donahue. Am. City, vol. 37, no. 3, Sept. 1927, pp. 304-308, 4 figs. Automatically controlled signals of standard type adopted; providing uniform traffic flow at maximum street capacity; "chronolizer" holds all signals in step and automatically resets any signals temporarily cut off.

SLAG

BLAST FURNACE, USE AS STRUCTURAL MATERIAL. Utilization of Blast Furnace Slag in Highway Improvement, C. E. Bardsley. Mo., Univ. of. School of Mines & Met.—Bul., vol. 10, no. 1, Nov. 1926, 115 pp. History, manufacture and use of slag as structural material; tests on blast furnace slag, their interpretations and conclusions; recommendations; bibliography.

SMOKE

DENSITY METER FOR. A Smoke-Density Meter, F. Sawford. Mech. Eng., vol. 49, no. 9, Sept. 1927, pp. 999-1004, 9 figs. A discussion of the desirability of measuring instruments in the modern boiler room; description of a recently developed meter for the measurement of smoke density, and an explanation of the manner in which such a meter may aid in the abatement of smoke and the improvement of furnace efficiencies.

SMOKE ABATEMENT

DENVER. What Denver is Doing to Abate Smoke, C. B. Roth. Am. City, vol. 37, no. 3, Sept. 1927, pp. 345-347. Intensive campaign carried on in 1925 moves Denver from 37th to 18th place among 150 cities inspected by government to determine prevalence of smoke.

SALT LAKE CITY. Salt Lake's Smoke and Smokeless Fuel Problem, L. C. Karrick. Salt Lake Min. Rev., vol. 29, no. 9, Aug. 15, 1927, pp. 13-15. Suggest an adequate and permanent source of rich gas, a suitable solid smokeless fuel and a furnace oil at low prices by installing in Salt Lake a central low-temperature coal-treating plant.

SPRINGS

HAIRSPRINGS. The Manufacture of Hairsprings, H. Moore and S. Beckinsale. Forging—Stamping—Heat Treating, vol. 13, no. 8, Aug. 1927, pp. 292-294 and 305. Heat-treating methods and their effect on properties of springs receive much consideration; comparison is made between springs of steel and non-ferrous metals.

RAILWAY. Railway Springs. Ry. Engr., vol. 48, nos. 570 and 571, July and Aug. 1927, pp. 249-250 and 293-295. Aspects of theory, design and construction with special reference to laminated bearing springs for locomotives. Abstract of paper read before Instn. Locomotive Engrs.

STANDARDIZATION

NATIONAL. National Standardization, L. W. W. Morrow. Elec. World, vol. 90, no. 10, Sept. 3, 1927, pp. 463-465. Functional set-up of organization within the industry to expedite standardization procedure; industry executives must be sold; complete reorganization proposed.

STEAM

HIGH-PRESSURE. High-Pressure Steam: Its Advantages and Disadvantages, H. Anderson. Elec. Jl., vol. 24, no. 9, Sept. 1927, pp. 426-429, 1 fig. Reviews progress in use of high-pressure steam and its advantages and disadvantages; thermodynamic gains; additional equipment required; operation and maintenance; economic considerations.

STEAM ENGINES

BEARING LUBRICATION. Bearing Lubrication of Vertical High-Speed Steam Engines. Commonwealth Engr., vol. 14, no. 11, June 1, 1927, pp. 433-435, 3 figs. Describes forced-feed circulation system and stresses importance of keeping system and oil clean by giving it daily attention: shows economic advantages of using correct oil.

STEAM POWER PLANTS

TORONTO, CANADA. Auxiliary Steam-Electric Power Station and Central Heating Plant. Elec. News, vol. 36, no. 16, Aug. 15, 1927, pp. 31-33, 1 fig. Report submitted by consulting engineers to Toronto Hydro-Electric Commission recommends stand-by system; coking plant not justified at present time.

STEAM TURBINES

DEVELOPMENT. Steam-Turbine Development, W. B. Spellmire. Engrs'. Soc. of West. Penn.—Proc., vol. 43, no. 4, May 1927, pp. 198-210, 10 figs. Discussion based on experience with General Electric Co.; developments at different stations.

TESTING. Terminology and Calculation Methods for Steam-Turbine Tests, N. A. Davidov. Thermo-Tech. Inst., no. 10, 1926, pp. 28-57, 5 figs. Discusses principles of testing various elements of steam-turbine plants and methods of representation and reduction of results; extensive bibliography of official testing codes and standards of all important European and American engineering organizations.

VIBRATION. A Remedy for a Case of Turbine Vibration, J. E. Housley. Power, vol. 66, no. 8, Aug. 23, 1927, pp. 286-287, 2 figs. Experience with a vertical 2,250-kw. turbine operating at 900 r.p.m.

STEEL

ALLOY. *See Alloy Steels.*

ANNEALING. The Annealing of Mild Steel Sheets, C. A. Edwards and J. C. Jones. Forging—Stamping—Heat Treating, vol. 13, no. 8, Aug. 1927, pp. 316-319. Investigation discloses influence of temperature on properties, as determined by Erichsen test, of sheets of varying thickness. See also Blast Furnace & Steel Plant, vol. 15, no. 8, Aug. 1927, pp. 396-399.

CARBON IN. Factors Affecting Total Carbon in Steel. Iron Age, vol. 120, no. 9, Sept. 1, 1927, p. 535. Important results from study of six German blast furnaces; silicon content and crucible temperatures affect carbon content.

CARBURIZING OF. Studies on Normal and Abnormal Carburizing Steels, O. E. Harder, L. J. Weber and T. E. Jerabek. Am. Soc. for Steel Treat.—Advance Paper, no. 12, for mtg. Sept. 19 to 23, 1927, 34 pp., 36 figs.

CASE HARDENING. Case Hardening of Steel by Means of Chloride of Silica (La cementation du fer par le chlorure de silicium), M. A. Sanfourche. Metallurgie et la Construction Mecanique, no. 32, Aug. 11, 1927, p. 19. Two series of experiments; steel was hardened to depth of 0.3 to 2.7 cm. after ½ to 3 hours' treatment with chloride of silica at temperatures ranging from 900 deg. cent. to 1,150 deg. cent.

CONSTITUTION OF. The Constitution of Steel and Cast Iron, F. T. Sisco. Am. Soe. for Steel Treat.—Trans., vol. 12, no. 2, Aug. 1927, pp. 279-290, 3 figs. Present installment, tenth of series, discusses effect of four common elements, silicon, sulphur, phosphorus and manganese on the iron-carbon alloys containing 2.00 per cent or more carbon—(the cast iron); each element is discussed under two heads: first, amount of element in cast iron and how the percentage is controlled: and, second, effect of the element on the constitutional changes, microstructure and properties.

DETERIORATION OF. Deterioration of Structural Steels in the Synthesis of Ammonia, J. S. Vanick. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 2, Aug. 1927, pp. 169-189 and (discussion) 189-194, 11 figs.

DIRECT FROM ORE. The Manufacture of Steel in "One Process" Direct from Ore, O. Smalley and F. Hodson. Am. Electrochem. Soc.—Advance Copy, for meeting Apr. 28, 29 and 30, 1927, pp. 706-723, 4 figs. Description of the Pehrson-Prentice and "Carsil" processes.

FATIGUE TESTS. Fatigue Tests of Carburized Steel, H. F. Moore and N. J. Alleman. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 14 pp., 12 figs.

HEAT-RESISTING. Heat-Resisting and Non-Corrodible Steels. Instn. of Aeronautical Engrs.—Jl., vol. 1, no. 8, Aug. 1927, pp. 5-44, 17 figs. Present paper is concerned with the products resulting from research carried out by Messrs. Hadfields, Ltd., of Sheffield, and by our French confreres, Messrs. Commentry Fourchambault et Decazeville, of Imphy, in whose laboratories were carried out the researches of the well-known metallurgists, Dumas, Guillaume, Chevenard, Muguet, Fayol and Girin.

HIGH-SPEED. *See Steel, High-Speed.*

HIGH TEMPERATURES, EFFECT OF. Properties of Steel at High Superheat Temperatures, A. McCance. Mech. World, vol. 81, no. 2111 and 2113, June 17 and July 1, 1927, pp. 434-435 and 5-6, 11 figs. Examination of temperature-strength curves for various steels; secondary effects of prolonged high temperature.

LOCOMOTIVE FORGINGS. Locomotive Forging Steels, O. V. Greene. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 16 pp., 18 figs. The author gives results of tests made on various types of heat-treated alloy steels for reciprocating locomotive parts.

METALLURGY. The Melting or Molten Stage of Steel Manufacture, with Particular Reference to the Deoxidizing, Refining and Contamination Phases, G. A. Dornin. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 6 pp.

PROPORTIONAL LIMIT AT HIGH TEMPERATURES. On the Significance of the Proportional Limit of Steel at Elevated Temperatures, F. B. Foley. Am. Soc. for Steel Treat.—Advance Paper, no. 13, for mtg. Sept. 19 to 23, 1927, 11 pp., 2 figs. Author believes that in elevated-temperature testing, the proportional limit is the sum of two factors, thermal expansion and mechanical stressing.

STEEL FOUNDRIES

ELECTRIC. Preheating Reduces Melting Period, E. Bremner. Foundry, vol. 55, no. 16, Aug. 15, 1927, p. 626-630 and 642, 7 figs. Description of Burnside Steel Foundry Co., Chicago, Ill.

STEEL, HEAT TREATMENT OF

BALL-BEARING STEEL. Heat Treatment for Two Ball-Bearing Steels, B. Kjerrman. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 20 pp., 8 figs. This paper gives results of electrical resistance tests on two ball-bearing steels, one of common type, the other with higher content of chromium and the addition of molybdenum.

CASTINGS AND FORGINGS. High Temperature Treatments of Castings and Forgings as Evidenced by Core Drill Tests from Heavy Sections, W. J. Merten. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 22 pp., 25 figs.

DEFINITION OF TERMS. Terms Relating to Heat Treatment. Forging—Stamping—Heat Treating, vol. 13, no. 8, Aug. 1927, pp. 300-301. Definitions are result of labours of committees, appointed by three societies, for purpose of clarifying terms whose meaning was uncertain.

DESIGN AND. Design from the Heat Treating Standpoint, G. M. Eaton. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 19 pp., 7 figs. The author stresses need for close co-operation between metallurgist and the mechanical engineer.

FURNACES AND METHODS. Modern Furnaces and Heat Treating Methods, E. F. Davis. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 2, Aug. 1927, pp. 291-302.

FUTURE OF. Heat Treatment is Adding Steadily to the Effective Service of Steel and Non-Ferrous Metals—Greater Things Just Ahead. Iron Age, vol. 120, no. 10, Sept. 8, 1927, pp. 609-620. Various opinions as to the future of heat treatment.

HARDENING. Hardening by Reheating After Cold Working, M. A. Grossmann and C. C. Snyder. Am. Soc. for Steel Treating—Preprint for 9th Annual Convention, Sept. 19 to 23, 1927, 16 pp., 18 figs.

PITFALLS IN. Pitfalls in Heat Treatment, J. W. Urquhart. Machy. (Lond.), vol. 30, no. 776, Aug. 25, 1927, pp. 658-659. Cracking; source of undisclosed cracking in steel; tempering the hardened zone; difficulties with non-uniformity of section.

QUENCHING. Oils as Quenching Media for Steels. Forging—Stamping—Heat Treating, vol. 13, no. 8, Aug. 1927, p. 326. Discussion of use of vegetable and mineral oils with slight reference to properties imparted by air.

What Happens When High-Speed Steel is Quenched, B. H. De Long and F. R. Palmer. Am. Soc. for Steel Treating—Preprint, for 9th Annual Convention, Sept. 19 to 23, 1927, 11 pp., 11 figs.

SELECTION OF EQUIPMENT. Selecting Electric Heat-Treating Equipment, E. Fleischmann. Machy. (N.Y.), vol. 34, no. 1, Sept. 1927, pp. 66-70, 7 figs. First of two articles explaining various points to be considered in planning installations.

STEEL, HIGH-SPEED

FAULTY HARDENING OF. Faulty Hardening of High-Speed Steel, E. Hundremont and H. Kallen. Eng. Progress, vol. 8, no. 8, Aug. 1927, pp. 199-200, 5 figs. Some examples of some faultily hardened high-speed steel parts.

SUBSTATIONS

MONTREAL. The Vallee Distribution Substation in Montreal, H. Milliken. Eng. Jl., vol. 10, no. 9, Sept. 1927, pp. 426-434, 10 figs. 60,000-kw. distribution substation recently built by Montreal Light, Heat and Power Consolidated in business district of city of Montreal; details of equipment, all of which is electrically controlled by one operator; special features.

WINDSOR, CANADA. New Hydro Substation at Windsor, H. V. Armstrong. Elec. News, vol. 36, no. 16, Aug. 15, 1927, pp. 25-27, 4 figs. Completely under synchronous visual type supervisory control from municipal station No. 1, where all totalizing is performed by thermal converter method of revote metering.

SUBWAYS

NEW YORK. Subsurface Structures in Subway Construction, M. I. Kohn. Eng. & Contracting, vol. 66, no. 8, Aug. 1927, pp. 369-374, 5 figs. How problems in building underground rapid transit system of New York City were handled described in Municipal Engrs. Jl.

T

TAPS

DESIGN AND CONSTRUCTION. Design and Construction of Taps, A. L. Valentine. Machy. (N.Y.), vol. 34, no. 1, Sept. 1927, pp. 57-61, 4 figs. Acme and square thread taps in sets; staybolt taps.

TELEPHONY

POWER LINE TRANSMISSION. Telephone Communication Over Power Lines by High Frequency Currents, C. A. Boddie. Inst. of Radio Engrs.—Proc., vol. 15, no. 7, July 1927, pp. 559-640, 39 figs. Power level; number of frequencies used per channel; method of obtaining duplex in two frequency systems; method of calling; type of selector; protective equipment; method of coupling to power line.

TEXTILES

AUTOMATIC LOOMS. Better Woollen and Worsted Weaving, with Special Reference to the Automatic Loom, B. F. Hayes. Textile World, vol. 72, no. 9, Aug. 27, 1927, pp. 44-47. Advice for overseer, fixer, weaver and dresser; weaving warps of fine single yarns.

TIDAL POWER

UTILIZATION. Power from the Sea, C. W. Olliver. Power Engr., vol. 22, no. 258, Sept. 1927, pp. 326-330, 11 figs. A study of the practicability of tidal power schemes and that of the utilization of the temperature variations of the sea.

TIRES, RUBBER

MANUFACTURE. Cycle Inner Tubes. India-Rubber Jl., vol. 74, no. 6, Aug. 6, 1927, pp. 211-217. Practical notes on their manufacture.

TRACTORS

STEAM. Steam Tractor for Overseas. Engineer, vol. 144, no. 3736, Aug. 19, 1927, pp 208-209, 4 figs. Engine develops 86 b.h.p.; it weighs without fuel and water 9 tons, and without spuds can exert draw bar pull of over 6,700 lb., and with spuds on firm ground it has, to use locomotive term, starting tractive effort of 10 tons.

TRANSFORMERS

TAP CHANGING. Control and Relay Equipment for Motor-Operated Transformer Tap Changer, W. R. Farley. Elec. Jl., vol. 24, no. 9, Sept. 1927, pp. 438-443, 9 figs. Methods of tap changing; relay equipment and production; position indicators; typical control circuits and automatic tap-changing control.

TUNNELS

RAILWAY. Progress of the Cascade Tunnel, Great Northern Ry. Eng. News-Rec., vol. 99, no. 6, Aug. 11, 1927, pp. 224-225, 3 figs. Work on 8-mile Rocky Mountain tunnel ahead of schedule; review of methods and advance to June 1927.

V

VACUUM TUBES

SILICA. Silica Valves in Wireless Telegraphy, H. Morris-Airey and H. G. Hughes. Instn. Elec. Engrs.—Jl., vol. 65, no. 368, Aug. 1927, pp. 786-790 and (discussion) 812-822, 7 figs. The paper discusses construction for naval purposes of wireless transmitting valves with silica envelopes; main properties of silica as envelope for high-power values are enumerated and valves are divided into two main classes, depending on whether anode heat is removed by radiation or by use of cooling fluid; description is given of electrode seals which have been developed to carry currents up to 100 amperes; various types of valves and methods of construction, evacuation and repair are described; dimensions of standardized valves and methods adopted for removing heat generated in various types of valve annodes are dealt with; operating conditions for transmitting circuits and methods of packing for transport are briefly referred to.

USE AS AMPLIFIERS. Modulation in Vacuum Tubes Used as Amplifiers, E. Peterson and H. P. Evans. Bell System Tech. Jl., vol. 6, no. 3, July 1927, pp. 442-460, 10 figs. Expressions for current components are developed in terms of coefficients of series, and modifications of Miller's method for greater convenience and precision in determinations of tube characteristics are described from which series coefficients may be evaluated; conclusions are drawn from solutions as to desirable tube characteristics by which, for example, single tube may take place of two tubes in push-pull connection; finally, certain properties of different types of tubes under conditions of maximum output power are compared on basis of constant and variable.

W

WASTE

INDUSTRIAL, DISPOSAL OF. Industrial Waste Disposal. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1659-1712. Symposium of five papers dealing with wastes in oil refineries, coal mines, pulp and paper mills and tanneries.

WATER POLLUTION

Oil. Controlling Oil Pollution of Waters, A. L. Fales. Water Wks. Eng., vol. 80, no. 18, Aug. 31, 1927, pp. 1251-1252. Progress of this work; its importance in water purification; various types of pollution; conferences and legislation.

WATER SUPPLY

Chlorination. Liquid Chlorine to Disinfect Water Mains, C. H. Eastwood. Contract Rec. & Eng. Rev., vol. 41, no. 31, Aug. 3, 1927, pp. 766-767. Methods by which danger of pollution is removed from new pipes.

WATER TREATMENT

Chlorination. Résumé of Progress in Chlorination, N. J. Howard. Water Wks., vol. 66, no. 9, Sept. 1927, pp. 371-372. Use of chlorine for prevention of algal growths and elimination of taste; conclusion from Toronto experiments on taste prevention.

Coagulation, Double. Double Coagulation for Turbid Waters, C. Bahlman and E. B. Evans. Am. City, vol. 37, no. 3, Sept. 1927, pp. 336-338. Investigation of double coagulation to determine (1) whether satisfactory water could be produced without chlorination, so that phenol tastes might be eliminated by temporary suspension of disinfection process; (2) whether double coagulation process would introduce additional safeguards in plant operation, so that chlorination process would become more truly factor of safety; (3) whether quality of plant output could be improved; (4) other advantages, such as lengthened filter, runs with decreased wash-water demands; and (5) relative costs of single and double coagulation.

Softening. Present Status of the Science of Water Softening, C. P. Hoover. Am. City, vol. 37, no. 3, Sept. 1927, pp. 313-321, 15 figs. Describes handling of chemicals; mixing devices; Dorr clarifiers; methods for further reducing hardness; substitution of zeolite for soda-ash to remove non-carbonate hardness and recarbonation.

WELDING

Aluminum Sheet. Welding Pure Aluminum Sheet, T. C. Fetherston. Am. Welding Soc.—Jl., vol. 6, no. 7, July 1927, pp. 29-36, 9 figs. Importance of selecting material of good welding quality, using welding rods and flux of proper composition and quality, etc.

Atomic-Hydrogen. Atomic-Hydrogen Welding Practicable. Chemicals, vol. 28, no. 9, Aug. 29, 1927, pp. 7-9, 3 figs. A new process by which hitherto unweldable metals can be melted and fused without the slightest trace of oxidation.

New Equipment Developed for Atomic-Hydrogen Welding. Automotive Industries, vol. 57, no. 7, Aug. 13, 1927, p. 237, 2 figs. Principle of operation same as in design previously announced by General Electric Co., but mechanical and electrical features are improved; three units in outfit.

Electric. *See Electric Welding, Arc.*

Multiple-Operator Plants. Multiple-Operator Arc Welding Plants for A.C. and D.C. Supplies, C. H. S. Tupholme. Mech. World, vol. 82, no. 2119, Aug. 12, 1927, p. 109, 1 fig. Types of control for a.c. and d.c. plants.

Oxy-Acetylene. *See Oxy-Acetylene Welding.*

Pipe Lines. Welding Pipe Lines in Building, H. E. Wetzell. Iron & Steel of Canada, vol. 10, no. 7, July 1927, pp. 216-218, 6 figs. From a paper read before meeting of Gas Products Association, French Lick Springs, June 21, 1927.

Tanks. Safe, Economical Storage for Fuel Oils, T. E. De Pew. Welding Engr., vol. 12, no. 8, Aug. 1927, pp. 37-40, 11 figs. Welded rectangular tanks of over 100,000 gallons capacity solve the storage problem at low construction cost.

Steel Manufacture. Welding a Factor in Steel Manufacture. Can. Machy. & Mfg. News, vol. 38, no. 7, Aug. 18, 1927, pp. 17-24, - figs. Utility of welding process in construction, maintenance, operation and dismantling of open-hearth furnaces is explained to emphasize economies possible from use of welding art.

Steel, Spot. Spot Welding of Dissimilar Metals, R. T. Gillette. Gen. Elec. Rev., vol. 30, no. 9, Sept. 1927, pp. 443-445, 6 figs. Uses of spot welding process; comparison with other methods; electrode material for dissimilar metals; electrode shape for unlike thicknesses; tests.

WELDS

Red-Shortness. The Red-Shortness of Weld Metal, A. H. Goodger. Welding Jl., vol. 24, nos. 285 and 286, June and July 1927, pp. 166-169 and 198-203, 24 figs., and (discussion) No. 387, Aug. 1927, pp. 230-232. Trouble is usually due to presence of certain impurities such as sulphur or oxygen, which may give rise to brittle films between grains; fractures are usually intergranular.

WIND TUNNELS

Open-Jet Cones. Study of Open-Jet Wind Tunnel Cones, F. E. Weick. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 260, Aug. 1927, 15 pp., 5 figs.

Variable-Density. Work in the Variable-Density Wind Tunnel of the N.A.C.A., E. N. Jacobs. Aviation, vol. 23, no. 11, Sept. 12, 1927, pp. 620-623. Summary of work carried on during past four years at laboratory of Natl. Advis. Comm. for Aeronautics at Langley Field.

WOOD

Preservation of. Experiments in Wood Preservation, L. P. Curtin. Indus. & Eng. Chem., vol. 19, no. 9, Sept. 1927, pp. 993-999, 3 figs. Arsenites of copper and zinc.

WOOD PRESERVATION

Research in. Experiments in Wood Preservation, L. P. Curtin. Indus. & Eng. Chem., vol. 19, no. 8, Aug. 1927, pp. 878-881. Production of acid by wood-rotting fungi. Report of a research undertaken for the Western Union Telegraph Company.

Z

ZINC

Commercial Applications. Progress in Commercial Applications of Zinc, J. A. Singmaster. Metal Industry (Lond.), vol. 31, nos. 2 and 3, July 15 and 22, 1927, pp. 31-33 and 61-62, 6 figs. Efforts of American Zinc Inst. to have zinc called zinc, not spelter, and galvanizing, zincing, are meeting with success; commercial grades of zinc; conflicting statements as to zinc; zinc for die castings; difficulties in die casting zinc-base metals; effect of lead and cadmium; strength of 93 zinc alloy.

Specifications. Tentative Specifications for Rolled Zinc. Am. Metal Market, vol. 34, no. 160, Aug. 18, 1927, pp. 8-9, 3 figs. This is a tentative standard only, published for the purpose of eliciting criticism and suggestions; it is not a standard of the Society and is subject to annual revision.

ZONING

America. Housing and the Regional Plan, J. Ihlder. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1513-1523. Variations in regional plans for different localities; separation and connection urban units; transit routes as district boundaries; city and neighbourhood facilities; classification of urban population and of houses.

Culture. Cultural Opportunities in Regional Planning, A. Wright. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1525-1532. Factors in regional planning which will create physical surroundings aiding production of cultivated community; provision for educational institutions, recreational facilities; design of public buildings, bridges, etc.

Future of. Forecast: The Regional Community of the Future, T. Adams. Am. Soc. Civ. Engrs.—Proc., vol. 53, no. 7, Sept. 1927, pp. 1533-1543. Some conditions and problems of modern cities; important trends in city development; New York's problems and future growth; the future urban region; new regional communities.

Engineering Index

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A

AERODYNAMICS

Model Experiments. Recent Model Experiments in Aerodynamics, R. G. Richardson. Roy. Aeronautical Soc.—Jl., vol. 31, no. 201, Sept. 1927, pp. 810-839 and (discussion) 839-843, 27 figs. Describes experiments on air flow in relation to models which lead up from fundamental ideas on "boundary layer" of Prandtl, through study of comparatively simple systems like cylinders and rotating cylinders and aerofoils, with sidelights on circulation theory of aerofoil, to complex systems like airscrew and supporting screw of auto-gyro. Bibliography.

AIR

Pollution, Measurement of. The Measurement of Atmospheric Pollution, Visible and Invisible, G. T. Moore. Mech. Eng., vol. 49, no. 10, Oct. 1927, pp. 1067-1068. Owens automatic air filter and jet dust counter for measuring solids in air; measurement of acidity in air; detecting presence of pathogenic organisms in air.

AIR CONDITIONING

Unit System. The Unit System Applied to Air Conditioning, H. P. Gant. Indus. Power, vol. 8, no. 3, Sept. 1927, pp. 58-60 and 64-66, 3 figs. Disadvantages of central system and advantages of unit system.

AIRPLANE ENGINES

Air-Cooled. Air-Cooled Engine Development, C. L. Lawrance. Aviation, vol. 23, no. 13, Sept. 26, 1927, pp. 723-725, 6 figs. Development of air-cooled engines in different countries before and since war.

AIRPLANES

Airfoil Tests. Air Force Tests of Sperry Messenger Model with Six Sets of Wings, J. M. Shoemaker. Nat. Advisory Comm. for Aeronautics, no. 269, 1927, 20 pp., 20 figs. Purpose of this test was to compare six well known airfoils, the R.A.F. 15, U.S.A. 5, U.S.A. 27, U.S.A. 35-B, Clark Y and Göttingen 387, fitted to the Sperry Messenger model, at full scale Reynolds number, as obtained in variable density wind funnel of the Nat. Advisory Comm. for Aeronautics; and to determine the scale effect on the model equipped with all the details of the actual airplane; results show a large decrease in minimum drag coefficient upon increasing the Reynolds number from about one-twentieth scale to full scale; maximum lift coefficient was increased with increasing scale for all airfoils except the Göttingen 387, for which it was slightly decreased; a comparison is made between the results of these tests and those obtained from tests made in this tunnel on airfoils alone.

Experiments on Airfoils with Trailing Edge Cut Away, J. Ackeret. Nat. Advisory Comm. for Aeronautics—Tech. Memorandums, no. 431, Sept. 1927, 10 pp., 6 figs. Experiments performed on two different airfoils with successive shortening of their chords to determine effect of cutting away trailing edge on lift and drag and on position of centre of pressure.

Bombers. The Boulton & Paul "Sidestrand." Flight, vol. 19, no. 37, Sept. 15, 1927, p. 645, 1 fig. Day-bomber fitted with two Bristol Jupiter engines; all-metal machine, with reduced "interference effect."

Commercial. The Kreider-Reisner "Challenger." Aviation, vol. 23, no. 14, Oct. 3, 1927, pp. 825-826. New three place light commercial plane is powered with an OX5 engine, carries useful load of 764 lb. and has high speed of 102 m.p.h.

Compasses for. The Installation and Correction of Compasses in Airplanes, M. F. Schoeffel. Nat. Advisory Committee for Aeronautics, no. 262, Aug. 1927, 17 pp., 4 figs.

Design. Design of Airplane Cellule (Le calcul d'une cellule d'avion basé sur les deformations de la cellule). Technique Automobile et Aerienne, vol. 18, no. 137, 1927, pp. 58-62, 4 figs. Elaborate mathematical analysis based on deformations of cellule; application of formulas derived, graphical representation.

Load Factor. A Load Factor Formula, R. G. Miller. Nat. Advisory Committee for Aeronautics, no. 263, Aug. 1927, 8 pp., 1 fig. Discussion of deriving formulas for determining proper load factor for design which will check actual experience and also be fundamentally rational in order to merit replacement of arbitrary factors.

Wheels. Static and Dynamic Behaviour of Standard Airplane Wheels (Il Comportamento Statico e Dinamico delle Ruote Unificate per Aeroplano), A. Guglielmetti and L. Ferrari. Rendiconti Tecnici della Direzione Generale del Genio Aeronautico—Ministero dell 'Aeronautica, vol. 15, no. 5, Sept. 1927, 40 pp., 56 figs. Report of tests, to collapse, of several sizes of wheels by static loads and impact; function of airplane wheels and their design in light of these tests.

AIRSHIPS

Resistance. Tests of the N.P.L. Airship Models in the Variable Density Wind Tunnel, G. J. Higgins. Nat. Advisory Comm. for Aeronautics—Tech. Notes, no. 264, Sept. 1927, 8 pp., 5 figs.

ALIGNMENT CHARTS

Horse Power Determination. Oil Engine Horse Power Nomograms, T. C. Crawhall. Marine Engr. & Motorship Bldr., vol. 50, no. 601, Sept. 1927, pp. 326-327, 2 figs. Two useful alignment charts for determining I.H.P. and B.H.P. of heavy oil engine. See also Shipbldg. & Shipg. Rec., vol. 30, no. 9, Sept. 1, 1927, pp. 236-237, 2 figs.

ALLOYS

Aluminum. *See Aluminum Alloys.*
Brass. *See Brass.*
Copper. *See Copper Alloys.*
Lead. *See Lead Alloys.*
Magnesium. *See Magnesium Alloys.*

Physical Properties. The Constitution and Physical Properties of Some of the Alloys of Copper, Zinc and Cadmium, C. H. M. Jenkins. Inst. of Metals—Advance Paper, no. 446, 1927, 39 pp., 59 figs. Constitution of the copper-zinc-cadmium alloys and the physical properties of the two most commonly used brasses containing small proportions of cadmium.

Tin. *See Tin Alloys.*

ALUMINUM

Corrosion. The Protection of Aluminium and Its Alloys Against Corrosion, H. Sutton and A. J. Sidery. Inst. of Metals—Advance Paper, no. 439, 1927, 17 pp., 10 figs. Also Engineering, vol. 124, no. 3218, Sept. 16, 1927, pp. 376-377.

ALUMINUM ALLOYS

Aluminum Bronze. Aluminum Bronzes (Etude sur les bronzes d'aluminium), J. Bouldoires. Revue de Metallurgie, vol. 24, nos. 7 and 8, July and Aug. 1927, pp. 357-376 and 463-473, 31 figs. Methods and results of an experimental study of heat reactions, electrical properties, density, hardness and micrography of aluminum alloys containing 80 to 95 per cent of copper; bibliography.

Duralumin. *See Duralumin.*

Silicon and Iron. The Constitution of Alloys of Aluminum with Silicon and Iron, A. G. C. Gwyer and H. W. L. Phillips. Inst. of Metals—Advance Paper, no. 443, 1927, 53 pp., 68 figs. See also Metal Ind. (Lond.), vol. 31, no. 11, Sept. 16, 1927, pp. 245-246.

Under-Cooling. The Under-Cooling of Some Aluminum Alloys, M. L. V. Gayler. Inst. of Metals—Advance Paper, no. 442, 1927, 28 pp., 34 figs.

APPRENTICES, TRAINING OF

Methods and Results. Am. Foundrymen's Assn.—Advance Paper, no. 27-28, June 6-10, 1927, 35 pp. Group of papers dealing with apprenticeship as labour stabilizer; making apprenticeship pay dividends; publicity to attract apprentices; reducing apprentice turnover by careful selection and supervision; apprentice training in Milwaukee and Pittsburgh; co-operation first essenital toward success in apprenticeship.

AUTOMOBILE ENGINES

Anti-Freeze Compounds. Anti-Freeze Compounds, D. B. Keyes. Indus. & Eng. Chem., vol. 19, no. 10, Oct. 1927, pp. 1119-1121. Reviews requirements of ideal anti-freeze compounds set up by automotive and chemical engineers. Bibliography.

AUTOMOBILE MANUFACTURING PLANTS

Ford Motor Co. Synchronizing Heating Processes into Straight Line Mechanical Production, J. B. Nealey. Fuels & Furnaces, vol. 5, no. 9, June 1927, pp. 1207-1212 and 1214, 10 figs.

AUTOMOBILES

Design and Maintenance. Design and Maintenance Costs. Motor Transport, vol. 45, no. 1175, Sept. 19, 1927, pp. 339-340. An investigation into the opportunities for constructional improvements that will facilitate repair operations.

Finishes. Automobile Finishes, H. C. Mougey. Indus. & Eng. Chem., vol. 19, no. 10, Oct. 1927, pp. 1102-1103. Contribution of chemist to development of paint and varnishes for automobiles; finishes which require high temperatures for drying, such as black baking enamel, and materials which may be dried at normal temperatures; lacquer finishes and their advantages.

Painting. Superiorities of Lacquer Finish in Automobile Painting, M. C. Hillick. Automotive Mfr., vol. 69, no. 6, Sept. 1927, pp. 21-22. How one-day paint job is produced; part produced by perfect surface preparation; durability and lustre; polishing.

Tires. Tires for 1928. Autocar, vol. 59, no. 1665, Sept. 30, 1927, pp. 650-651, 20 figs. Advance of well-base rim, and introduction of a new pattern; electrical deposition of rubber; remarkable longevity of covers despite Cavalier treatment by many motorists; medium pressures for inflation; road adhesion and tread patterns.

AUTOMOTIVE FUELS

Anti-Knock. New Apparatus Gauges Anti-Knock Characteristics of Fuel. Automotive Indus., vol. 57, no. 16, Oct. 15, 1927, pp. 588-589, 2 figs. Consists of single-cylinder water-cooled engine fitted with Midgley bouncing pin device and is designed primarily for refiners distributing ethyl gasoline.

Sources. Many Future Sources of Motor Fuel, J. C. Morrell and G. Egloff. Oil & Gas. Jl., vol. 26, no. 18, Sept. 22, 1927, pp. 202 and 400-404.

AUTOMOTIVE INDUSTRY

Developments. Highly-Developed Inspection Equipment Has Raised Production Standards. K. W. Stillman. Automotive Indus., vol. 57, no. 14, Oct. 1, 1927, pp. 474-479, 11 figs. Industry is constantly finding new means of insuring accuracy in mass production of parts; specially designed devices are found in many plants; photo-electric cell offers possibilities.

B

BEAMS

Reinforced Concrete. An Investigation of Web Stresses in Reinforced Concrete Beams, F. E. Richart. Univ. of Ill. Bul., vol. 24, no. 43, June 21, 1927, 106 pp., 34 figs. Results of tests of 139 reinforced concrete beams made from 1910 to 1921; beams were reinforced in variety of ways, particular attention being given to types of reinforcement that would offer resistance to diagonal tension and bond: describes materials, test-pieces and methods of testing, and discusses results.

BLAST FURNACES

Improved. Wheeling Steel Corporation's New Furnace. Blast Furnace & Steel Plant, vol. 15, no. 9, Sept. 1927, pp. 444-445, 6 figs. Blast furnace features novel development in gas wasting; capacity equal to production of largest furnaces; bells operated by electric hoists.

BOILER FIRING

Pulverized Coal. Steam Plant Firing with Pulverized Coal (La chauffe des generateurs de vapeur au charbon pulverise), M. Emanaud. Technique Moderne. vol. 19, no. 18, Sept. 15, 1927, pp. 561-566. 8 figs.

Practice. The Theory of the Blast Furnace Process. F. Wüst. Iron & Coal Trades Rev., vol. 115, no. 3109, Sept. 30, 1927, pp. 494-495, 2 figs. Presents arguments showing that manganese silicon and phosphorus cannot be taken up by iron in any considerable quantity in blast furnace bosh.

BOILER FURNACES

Water Screens and Walls. Plant Gives Data on Water Screens and Walls. Power Plant Eng., vol. 31, no. 19, Oct. 1, 1927, pp. 1026-1027, 6 figs. Heat absorption equivalent to over 2,000 per cent rating has been measured in water screens which have revolutionized furnace construction in the past few years.

BOILERS

Electric. The Sulzer Electric Boiler. Sulzer Tech. Rev., no. 3, 1927, 19 pp., 31 figs. Describes different types of electric boilers, and their uses, and lists some installations.

Fuel Economy. Fuel Economizers for Heating Boilers, E. Williams. Domestic Eng. (Chicago), vol. 12, no. 1, Oct. 1, 1927, pp. 30-32, 5 figs. Use of fuel economizers on high-pressure boilers to absorb large portion of heating contained in flue gases before they enter chimney; successful use for this purpose has led to their adoption for heating boilers.

Locomotive. *See Locomotive Boilers.*

Waste-Heat. Waste-Heat Boiler Application, J. B. Crane. Blast Furnace & Steel Plant, vol. 15, no. 9, Sept. 1927, pp. 448-449 and 453, 5 figs. A concise recital of the economical and practical aspects entering into the selection and installation of boilers for the recovery of waste heat.

BORING MACHINES

Design. Three-Spindle High-Precision Jig Boring Machine. Machy. (Lond.), vol. 3', no. 782, Oct. 6, 1927, pp. 16-18, 4 figs. Developments in design of boring machines by Société Genevoise, London.

BRASS

Heat-Treatment. Heat-Treating Brass Parts in Process, K. C. Monroe. Am. Mach., vol. 67, no. 13, Sept. 29, 1927, pp. 491-494, 6 figs.

BRIDGES

New Zealand. The Mokau Bridge, Taranaki, New Zealand. Engineer, vol. 144, no. 3735, Aug. 12, 1927, pp. 171-172, 4 figs. Methods used in constructing reinforced concrete piers for an eleven-span bridge.

Relocation. Dismantling Top Chord of Sixth Street Bridge, Pittsburgh, D. T. Jerman. Eng. News-Rec., vol. 99, no. 12, Sept. 22, 1927, p. 473. Height of trusses cut down to clear two bridges while being floated to new site; truss of bowstring type.

BRIDGES, CONCRETE

Reinforced. Design for Reinforced Concrete Bridge at Prague. Concrete & Constr. Eng., vol. 22, no. 9, Sept. 1927, pp. 523-527, 5 figs. Proposed span of 886 ft. passing over Nulse Valley to connect city of Prague with suburb.

BRIDGES, HIGHWAY

Mississippi River. Five New Highway Bridges Across Mississippi River, H. H. Lotter. Eng. News-Rec., vol. 99, no. 11, Sept. 15, 1927, p. 431. New crossings being built at Louisiana, Alton, Chain of Rocks, Cape Girardeau and Cairo.

North Dakota. Missouri River Highway Bridges in North Dakota, C. Johnson. Eng. News-Rec., vol. 99, no. 11, Sept. 15, 1927, pp. 426-428, 3 figs. State opens two new river crossings; pneumatic and open-dredged caissons; pier design and truss spans.

BRIDGES, RAILWAY

Sangamon River. Wabash Railway Builds New Bridge Over Sangamon River, S. M. Smith. Eng. News-Rec., vol. 99, no. 12, Sept. 22, 1927, pp. 464-465, 4 figs. Double-track plate-girder spans replace truss bridge; concrete deck; novel subway design; erection methods.

Steel. Forty Bridge Spans Erected in Four Days. Ry. Eng. & Maintenance, vol. 23, no. 10, Oct. 1927, pp. 408-410, 3 figs. Union Pacific places 848 tons of steel over North Platte river in record time.

BRIDGES, STEEL

Missouri River. Cantilever Erection of Long Spans of Missouri River Bridge, L. J. Sverdrup. Eng. News-Rec., vol. 99, no. 15, Oct. 13, 1927, pp. 590-592, 4 figs. Flood and drift danger at Waverly site led to adoption of method of cantilevering over temporary bents.

BRIDGES, SUSPENSION

Windsor-Detroit. Windsor-Detroit International Bridge, P. L. Pratley. Can. Engr., vol. 53, no. 13, Sept. 27, 1927, pp. 323-326, 6 figs. Preliminary details of long suspension bridge to be built across Detroit river at estimated cost of $22,000,000; main span is 1,850 ft. and total length 3,625 ft.; minimum clearance is 152 ft. and towers are 362 ft. high.

BUILDING CONSTRUCTION

Foundations, St. Louis Telephone Building. Open Pier Foundations of St. Louis Telephone Building, W. J. Knight. Eng. News-Rec., vol. 99, no. 14, Oct. 6, 1927, pp. 536-539, 6 figs. Subsoil exploration and load tests; open-wall piers sunk to rock through clay, sand and boulder layers; basement walls built in trench and supported on brackets from adjacent piers.

BUILDINGS

Dead Loads. Dead Loads of Tier Buildings, R. Fleming. Eng. News-Rec., vol. 99, no. 12, Sept. 22, 1927, pp. 470-472. Correct calculation of dead loads often neglected in design of framework; partition loads troublesome.

Industrial. Large One-Storey Industrial Building, 2,400 x 500 Ft., N. J. Bell. Eng. News-Rec., vol. 99, no. 13, Sept. 29, 1927, pp. 496-499, 3 figs. Stock, manufacture and storage of refrigerator cabinets all provided on one floor; alternate monitor and flat roof spans; conveyors serve warehouse.

C

CABLES, ELECTRIC

High-Tension. Gas Films in High-Tension Cables, L. Emanueli. Elec. World, vol. 90, no. 13, Sept. 24, 1927, pp. 601-604, 9 figs. Tests show that bombardment of compound by gaseous ions causes air emulsion and forces path through impregnated paper fibre, leading eventually to dielectric breakdown.

Insulating Paper. The Influence of Residual Air and Moisture in Impregnated Paper Insulation, J. B. Whithead and F. Hamburger, Jr. Paper presented before the Baltimore Section of Am. Inst. Elec. Engrs., Dec. 16, 1926, 20 pp., 44 figs. Describes experiments in study of the separate influence of residual air and moisture in impregnated paper as used for the insulation of high voltage cables.

CABLEWAYS

Ore Handling. A Funicular Cableway on the Island of Cyprus (Le funiculaire aéien de l'ile de Chypre pour le transport de l'amiante), G. Brillo. Génie Civil, vol. 91, no. 11, Sept. 10, 1927, pp. 253-255, 13 figs. Description of funicular for transportation of asbestos fibre from elevation of about 1,300 m. to sea level at Limassol, 29.4 km. long; details of steel towers, costs.

CANALS

Welland, Canada. The Welland Ship Canal. Engineer, vol. 144, no. 3736, Aug. 19, 1927, pp. 198-199, 2 figs. Some figures on canal, its locks and costs.

CARS, FREIGHT

Curve Resistance. Freight Train Curve Resistance on a One-Degree Curve and on a Three-Degree Curve, E. C. Schmidt. Univ. of Ill. Bul., vol. 24, no. 45. July 12, 1927, 47 pp., 15 figs. Results of tests made with five freight trains on one-degree and three-degree curves; results relate exclusively to resistance of cars composing trains, and apply only to freight trains with four-wheeled trucks.

CAST IRON

Diesel Engines. Properties and Heat Treatment of Cast Iron for Diesel Engines, F. B. Coyle. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 3, Sept. 1927, pp. 446-465, 18 figs. Necessity for higher quality cast iron to withstand higher working temperatures and higher pressures in Diesel engine operations; author believes that research should be directed toward compositions which have a lower carbon and silicon content than have usually been produced in the past.

CASTINGS

Cleaning. Cleaning Castings with a Blast of Sand, E. G. Brock. Can. Foundryman & Electroplater, vol. 18, no. 8, Aug. 1927, pp. 7-9. Whether in form of room, table or barrel, sand-blast equipment is steadily gaining approval of foundry executives who seek to attain maximum production at minimum cost.

Sandblasting Forged and Treated Parts, C. J. Stiers. Forging—Stamping—Heat Treating, vol. 13, no. 9, Sept. 1927, pp. 367-368. Use of sandblasting for cleaning forgings, castings, drills, connecting rods and many heat-treating parts; choosing equipment for particular shape of piece and tonnage.

CEMENT, PORTLAND

Mills, Electric Power for. Cement Plant—A Large Power User. Elec. World, vol. 90, no. 14, Oct. 1, 1927, pp. 681-687. Phoenix Portland Cement Corp. in Birmingham has 4,000-bbl. capacity, uses 7,500 h.p. and has 3,000-kw. demand; very large grinding mill and kiln drives.

CENTRAL STATIONS

Automatic Boiler Control. Hagan Automatic Boiler Control. Engineering, vol. 124, no. 3217, Sept. 9, 1927, pp. 325-327. Problems at Port Morris power station of N.Y. Central R.R. and description of automatic boiler control employed.

Design. A Departure from Standard Station Design. Elec. Light & Power, vol. 5, no. 9, Sept. 1927, pp. 21-23. Describes new station of Waukegan Generating Co., Waukegan, Ill.; design of this station embodies departure from standard Am. generating station development.

Grounding Systems. Grounding Systems for Electric Stations, C. M. Rhoades. Power Plant Eng., vol. 31, nos. 11 and 12, June 1 and 15, 1927, pp. 625-627 and 684-685. June 1: Discusses grounding from both practical and theoretical viewpoint. June 15: Grounding requirements for different equipment; methods for artificial treatment of soil.

Interconnection. The Calculation of Interconnector Synchronizing Power, S. A. Stigant and H. M. Lacey. World Power, vol. 8, no. 44, Aug. 1927, pp. 67-70, 4 figs. This article shows how to calculate average synchronizing power of interconnector between two power stations by means of simple trigonometrical and geometrical terms; calculations are given in detail for cases of equal and unequal station bus-bar pressures, and, while general solution is that covered by latter case, it is shown that form of two cases is identical.

Steel Structure. Steel Construction in Power Plants. Power Plant Eng., vol. 31, no. 19, Oct. 1, 1927, pp. 1028-1030, 5 figs. Comparative structural costs of Holtwood and Richmond stations; various uses of steel in power plant construction.

Plant Construction. Organization for Construction, A. S. Douglass. Elec. World, vol. 90, no. 15, Oct. 8, 1927, pp. 731-737. Detroit Edison Co. set-up makes construction an integral function; executive and engineering decisions on design essential; necessity for co-ordination of material and equipment deliveries with construction progress.

CHIMNEYS

Building Codes. Chimney Requirements Established by Kansas City's Building Codes. Sheet Metal Worker, vol. 18, no. 15, Aug. 26, 1927, pp. 558-559. Reprint of the section covering chimneys, flues, woodwork around chimneys and fireplaces of building code adopted by Kansas City last March; as this is regarded as a model code, it may be accepted as setting practical standards of good practice.

CHROMIUM PLATING

Processes. A Detailed Study of Chromium Plating. H. E. Haring and W. P. Barrows. Brass World, vol. 23, no. 9, Sept. 1927, pp. 299-305. Three types of chromic acid bath shown to give same results; additional light on process results from study at Bureau of Standards. Abstracted from U.S. Bur. Standards, Tech. Paper, no. 346.

CIRCUIT BREAKERS

Oil. Rules for Applying Oil Circuit Breakers, H. G. MacDonald. Power, vol. 66, no. 12, Sept. 20, 1927, pp. 428-431, 5 figs. Factors that should be considered when selecting oil circuit breakers and features that these devices should possess to meet operating conditions successfully.

Tests on High- and Low-Voltage Oil Circuit Breakers, P. Sporn and H. P. St. Clair. Paper presented at Winter Convention of A.I.E.E., New York, Feb. 7-11, 1927, 23 pp., 34 figs. Data from a large number of tests on several types of oil circuit breakers; tests were made on breakers with the following ratings: (a) 150 kv., 1,500,000 kv.a.; (b) 35 kv., 250,000 kv.a.; (c) 7,000 volts, 7,500 kv.a.; (d) 132 kv., 1,250,000 kv.a., and (e) 132 kv., 750,000 kv.a.; these tests were made on power systems having sufficient connected capacity to make tests conclusive; complete data are tabulated and oscillograms are shown.

COAL

Chemistry of. The Chemistry of Coal, R. V. Wheeler. Engineering, vol. 124, no. 3217, Sept. 9, 1927, pp. 344-346. Description of study of coal to determine separately character of contribution made by each of more important individual coal-forming materials of plants. See also Chem. & Ind., vol. 46, no. 38, Sept. 23, 1927, pp. 848-854.

COKE OVENS

Toronto. Proposed Coking Plant for Toronto. Can. Engr., vol. 53, no. 13, Sept. 27, 1927, pp. 333-336. Report by Toronto Board of Control favours establishment of coke oven plant in connection with auxiliary steam power station; outlet for gas generated essential for success of undertaking; high and low temperature carbonization processes compared.

COMBUSTION

Control. The L. and N. Automatic Combustion Control System. Eng. & Boiler House Rev., vol. 41, no. 3, Sept. 1927, pp. 109-112, 2 figs. Describes Leeds and Northrup system of automatic combustion control, in which more general use is made of electrical control, and steam flow variations in main are utilized to operate whole system electrically.

CONCRETE

Aggregates. The Determination of Free-Water Content of Field Aggregates, R. P. V. Marquardson. Eng. & Contracting, vol. 66, no. 9, Sept. 1927, pp. 401-402, 1 fig. Direct method for determining percentage of free water in, or percentage of lack of water for a full-absorption conditon of, field aggregates used in concrete mixtures.

Handling. Moving Concrete from Mixer to the Job, N. L. Doe. Eng. World, vol. 31, no. 4, Oct. 1927, pp. 217-219. Description of equipment for transferring concrete from mixer to the job.

Strength of. Concrete Strength as Influenced by Grading of Sand, J. G. Rose. Highway Engr. & Contractor, vol. 17, no. 3, Sept. 1927, pp. 47-48. In connection with testing of materials for federal-aid highway projects in Colorado, study has been made of relation between grading of sand for use in concrete and strength developed in mortar and concrete; study has led to development of graph which may be used as basis for preliminary judgment of quality of sands proposed for use.

Water-Cement Ratio. Water Control in, and Design of Mixtures for, the Production of Water-Cement-Ratio Concrete, R. P. V. Marquardsen. Eng. & Contracting, vol. 66, no. 9, Sept. 1927, pp. 413-417, 6 figs. Simplified method for designing water-cement-ratio concrete mixtures that obviates drying out of aggregates to find the free-water content, automatically makes allowance for bulking, and introduces several other short cuts.

CONCRETE CONSTRUCTION

Bulkheads and Sea Walls. Precast Concrete Bulkheads and Sea Walls, R. M. Miller. Eng. & Contracting, vol. 66, no. 5, May 1927, pp. 201-204, 4 figs. Types of construction on east coast of Florida; placing of reinforcement; concrete casing around piles; effect of sea water on concrete.

CONCRETE CONSTRUCTION, REINFORCED

Precast. Precast Reinforced Concrete Construction, A. J. Hodgkinson. Structural Engr., vol. 5, no. 9, Sept. 1927, pp. 285-295, 11 figs. Investigation of beam constructed from precast blocks of hollow type having grooves on all sides, the four edges bevelled and a diagonal cast in the block.

CONCRETE, REINFORCED

Piles. Macarthur Compressed Concrete Piles. Engineering, vol. 124, no. 3214, Aug. 19, 1927, p. 232, 3 figs. Three types are discussed: (1) cast in plan, (2) compressed concrete pedestal, and (3) composite compressed concrete and timber.

Sea Water Effect on. The Life of Reinforced Concrete Piling in Sea Water, A. L. Sonderegger. West. Constr. News, vol. 2, no. 18, Sept. 25, 1927, pp. 33-36, 6 figs. Examination of reinforced concrete piling in harbours of California shows extensive deterioration of reinforcing rods and reveals necessity of extreme caution in design.

Steel Assemblies. Steel Assemblies for Reinforced Concrete, T. P. Francis. Surveyor & Mun. & County Engr., vol. 72, no. 1858, Sept. 2, 1927, pp. 199-200. Importance of skilled supervision of steel assemblies for reinforced concrete; checking consignments; bending; assembling; costs, etc.

CONVEYORS

Belt. Belt Conveyors Used in Construction of Wanaque Dams, A. H. Pratt. Contractors & Engrs. Monthly, vol. 15, no. 2, Aug. 1927, pp. 55-62, 11 figs. Describes belt conveyor system used in connection with various operations in construction of dams for Wanaque reservoir, New Jersey; about 2½ mi. of belt conveyor were used.

Increasing Factory Capacity. Conveyor System Doubles Capacity, B. Finney. Iron Age, vol. 120, no. 14, Oct. 6, 1927, pp. 933-936, 6 figs. Total output of the finishing and assembling departments of the Monitor Furnace Co., Cincinnati, manufacturer of Caloric heating furnaces, has been increased 100 per cent by the installation of a conveying system for transporting rough casting through the finishing operations and thence to warehouse to await shipment to customers; in addition, mechanical handling of material has cut down normal working force by 11 men, a considerable saving in labour cost thereby being effected; furthermore, use of conveyors has brought about other economies which, considered on an annual basis, amount to an impressive sum.

Platform. Overhaul by Conveyor Platform, H. W. Blake. Am. Mach., vol. 67, no. 15, Oct. 13, 1927, pp. 577-578, 2 figs. European electric railways adopt Henry Ford construction methods in overhaul of their equipment; entire shop based on this principle designed by London Underground Electric Railway.

COPPER ALLOYS

Copper-Gold. Treatment of Home Copper-Gold Ores—The Ore and Method of Extracting It, H. L. Roscoe. Can. Min. Jl., vol. 48, no. 39, Sept. 30, 1927, pp. 767-768.

Copper-Magnesium. The Copper-Magnesium Alloys, W. T. Cook and W. R. D. Jones. Inst. of Metals—Advance Paper, no. 434, 1927, 22 pp., 7 figs. Investigation on the forging of copper-magnesium alloys; ductility of alloys depends primarily on the forging temperature; addition of copper to magnesium up to about 2 per cent is beneficial.

Copper-Tin. The Equilibrium Diagram of Copper-Tin Alloys Containing from 10 to 25 Atomic Per Cent of Tin, A. P. Raper. Inst. of Metals—Advance Paper, no. 437, 1927, 15 pp., 20 figs. This investigation on the copper-tin alloys forms a continuation of the work done by Stockdale on this system; alloys have been examined both by thermal and micrographic analysis, and results obtained have confirmed in many respects the classical work of Roberts-Austen and Heycock and Neville.

COPPER METALLURGY

Ore Treatment. The Treatment of Rouyn Copper Ores, H. H. Claudet. Can. Min. Jl., vol. 48, no. 38, Sept. 23, 1927, pp. 751-753. Describes principal ores of Rouyn mining district in Western Quebec; their treatment.

COPPER MINING

Electrical Equipment. Electrical Practice in Copper Mining, W. C. Heston. Elec. World, vol. 90, no. 14, Oct. 1, 1927, pp. 671-679. Anaconda Copper Mining Co. purchases 27,000 kw. for mine operation; electrification practically complete; power supply, construction, haulage, hoisting and signals are dis-

COST ACCOUNTING

Building Construction. Keeping the Costs on a Building Job. Eng. & Contracting, vol. 66, no. 5, May 1927, pp. 215-225. How Wells Brothers Construction Co., Chicago, are simplifying cost finding on large project with system readily adapted to work of any magnitude; notes on construction methods.

CRANES

Cross-Winding. Cross-Winding in Travelling Cranes. Mechanical World, vol. 82, no. 2123, Sept. 9, 1927, p. 181, 1 fig. Causes of cross-winding in travelling cranes and methods of preventing.

Electric. Electric Crane Practice, W. E. Richardson. Elec. Rev., vol. 101, no. 2600, Sept. 23, 1927, pp. 497-498. The maintenance of electric cranes in the steel mill, some of the causes of breakdowns and suggestions for their prevention.

Electric Motors for. The New Loading Crane at the Petit-Huningue Wharf Near Basle, E. Altschul. Brown Boveri Rev., vol. 14, no. 9, Sept. 1927, pp. 223-227, 4 figs. Description of cranes equipped with single-phase commutator motors, used for loading and unloading vessels at Petit-Huningue wharf near Basle.

CUPOLAS

Firing. The Auxiliary Powdered Coal Firing of Cupolas. Foundry Trade Jl., vol. 36, no. 579, Sept. 22, 1927, pp. 259-261, 1 fig. Review of experimental work and results.

D

DAMS

Arch. The Analysis of Circular Arch Dams by Cain's Method, Including Shear, C. E. Pearce. West. Constr. News, vol. 2, no. 17, Sept. 10, 1927, pp. 35-38, 1 fig. Presents some tables which have been unsuccessfully used and which lessen the amount of labour involved in making Cain's analysis of arch dams, when including shear; gives several sample computations.

Coolidge, Arizona. The Coolidge Multiple-Dome Dam, Arizona. West. Constr. News, vol. 2, no. 18, Sept. 25, 1927, pp. 47-48, 1 fig. Progress in construction of Coolidge dam; construction plant nearly installed and foundation excavation about completed.

Gravity. Some Examples of the Design of High Gravity Dams, N. B. Hunt. West. Constr. News, vol. 2, no. 18, Sept. 25, 1927, pp. 42-45, 4 figs. Method developed by William Cain for determining stresses in gravity dams has recently been adopted by a number of engineers concerned with design of dams wherein extraordinary height has emphasized its fundamental departure from theories in general use; practical consideration incidental to application of Cain's theory to Colorado river dams are subject of this article.

Gros Ventre. Further Data on Failure of the Gros Ventre "Dam." Eng. News-Rec., vol. 99, no. 15, Oct. 13, 1927, pp. 600-601, 5 figs. Disastrous slip of earth barrier on river in Wyoming stresses need for care in grading earth dam material.

DIE CASTING

Dies for. Pressure Dies for Die-Casting. Machy. (Lond.), vol. 30, no. 777, Sept. 1, 1927, pp. 685-688, 5 figs. Die design governed by degree of intricacy and knowledge of likely number of castings and by necessary speed of casting; other considerations to be kept in mind; typical examples.

DIES

Die Blocks, Heat Treatment of. Heat Treatment of Die Blocks. Machy. (Lond.), vol. 31, no. 782, Oct. 6, 1927, pp. 9-11. Tentative practice approved by recommended practice committee of American Society for Steel Treating.

Forming. Drawing, Forming and Piercing Dies, F. A. Stanley. West. Machy. World, vol. 18, no. 9, Sept. 1927, pp. 431-433, 5 figs. Describes some of press-tool work of Poulsen & Nardon, Los Angeles, Cal.

DIESEL ENGINES

Allen. Auxiliary Generating Machinery. Brit. Motorship, vol. 8, no. 90, Sept. 1927, pp. 228-229. New design of Allen Diesel engine with monobloc cylinders whereby cylinder bases from single casting, although top portion of jackets are separated to allow for expansion; this applies to two-cylinder and three-cylinder models; with four-cylinder engines, two castings are employed, each comprising single base for pair of jackets in which are inserted removable liners.

Automotive Purposes. Diesel Engine Position. Autocar, vol. 59, no. 1661, Sept. 2, 1927, pp. 413-416, 9 figs. Article by engineer who is closely in touch with Continental design reviews present position, setting forth general principles and advantages of Diesel and semi-Diesel engines, and indicating difficulties to be overcome.

Cylinder Lubrication. Lubricating Power Cylinders of Diesel Engines, W. O. Northcutt. Mech. Eng., vol. 49, no. 10, Oct. 1927, pp. 1068-1070, 3 figs. Purpose of paper is to offer constructive criticism of present methods of applying lubricating oil to power cylinders of Diesel engines, and to recommend a method which is believed to be an improvement; discussion, data and conclusion are based on an experimental study of this phase of Diesel-engine lubrication; report of tests conducted show ill effects of oxidation.

High-Speed. Developments in High-Speed Diesel Engines. Power Plant Eng., vol. 31, no. 18, Sept. 15, 1927, pp. 987-988, 3 figs. New line of Fairbanks-Morse Diesel engines in speeds ranging from 500 to 800 r.p.m. and ratings from 30 to 180 h.p. show trend in design.

Installation Costs. Installation Costs of Diesel Engines, E. J. Kates. Power Plant Eng., vol. 31, no. 19, Oct. 1, 1927, pp. 1043-1044. Data showing that industrial plant installation costs are lower than those of central stations.

Liner Wear. Liner Wear on Diesel Engines, C. G. A. Rosen. Pac. Mar. Rev., vol. 24, no. 10, Oct. 1927, pp. 466-467, 3 figs. Causes of liner wear said to involve influence of heat, pressure and speed on lubrication, metals and design; these factors also related to quality of fuel oil employed.

M.A.N. An American Double-Acting Engine. Brit. Motorship, vol. 8, no. 90, Sept. 1927, pp. 202-206, 5 figs. Describes 3,600 boiler h.p. Nelseco-M.A.N. four-cylinder, two-stroke, double-acting motor to be installed in converted steamer "Wilscox," said to represent highest engine output of any marine Diesel motor hitherto constructed in U.S.

Tests of Hamilton-M.A.N. Diesel Engine. Mara. Eng. & Shpg. Age, vol. 32, no. 10, Oct. 1927, p. 565. Results of shop tests of Hooven-Owens-Rentschler engine constructed for Shipping Board Diesel conversion programme for installation in 9,600-ton cargo ship Seminole.

Valves. Care of Diesel Engine Valves, E. Ingham. Gas & Oil Power, vol. 23, no. 265, Oct. 6, 1927, p. 1. Safe and satisfactory running of Diesel engines depends in large measure on their careful maintenance; importance of perfect adjustment and condition of fuel valve.

DREDGING

SAND. Simple Dredging Method by Pioneer Sand Company, R. A. Goodwin. Cement Mill & Quarry, vol. 31, no. 5, Sept. 5, 1927, pp. 7-9, 7 figs. Describes plant of Pioneer Sand Co. for dredging sand from Missouri river; consists essentially of a centrifugal pump which lifts the material from the river bed to a fan-shaped spreading table on the dredge; sand and water pass through a grizzly screen before discharging onto table; they then are spread out in a thin layer as they flow down toward the lower and wider end, and are received on an inclined screen where fine sands are washed to the river and material over 14-mesh is spouted to the barges.

DURALUMIN

USES OF. The Use of Duralumin in the Manufacture of an All-Metal Artificial Limb, N. F. Parkinson. Eng. Jl., vol. 10, no. 10, Oct. 1927, pp. 451-458, 7 figs. Refers to its use for this purpose by Canadian government and gives some detailed information as to properties of duralumin; development of limb manufacture to meet war conditions; properties of duralumin and effect of heat treatment, work and corrosion; effect of mechanical work and annealing temperatures.

E

ELECTRIC DISTRIBUTION SYSTEMS

SUPERVISORY SYSTEMS. Experience with Supervisory System, F. O. Jenkins. Elec. World, vol. 90, no. 13, Sept. 24, 1927, pp. 613-616, 4 figs. Necessity for complete isolation from control circuits; troubles encountered in operation, their causes and corrections; supervision over fully automatic system approaches service ideal.

ELECTRIC DRIVE

INFLUENCE ON INDUSTRY. Conditions and Effects of Electric Drives as Compared with Older Methods, R. H. Rogers. West. Machy. World, vol. 18, no. 9, Sept. 1927, pp. 434-436. Outlines some of broader and perhaps less obvious effects of electricity in industry; retirement of industrial plants to large industrial centres; change in conditions for personnel of industry; release of space and capital for application to production; conservation of natural resources; high rate of production that now prevails through agency of electric power; production costs; release of space and capital for application to production.

ELECTRIC FURNACES

ANNEALING. Electric Furnace Used in Annealing Cylinders for Air Cooled Engines, I. S. Wishoski. Fuels & Furnaces, vol. 5, no. 9, June 1927, pp. 1199-1202, 2 figs. Electric furnace of recuperative return type with automatically operated pusher mechanism proves very efficient in annealing automobile engine cylinders.

POT-TYPE. Low and High Temperature Electric Pot Furnaces, E. Fleischmann. Indus. Mgmt. (N.Y.), vol. 74, no. 3, Sept. 1927, pp. 177-182, 9 figs. Points out major points of importance in selection of pot-type furnace for either low or high temperature work and reasons theerfor.

STEEL. High-Frequency Induction Melting, D. F. Campbell. Iron & Steel Inst.—Advance Paper, no. 1, Sept. 1927, 8 pp.. 4 figs. Scope of high-frequency heating is expanding as rapidly as electrical machinery constructors can meet the requirements imposed upon them, and progress both in melting and heating of steel is being rapidly accomplished; its value is, however, already well established as a method of making crucible steel of remarkable homogeneity at a low cost, with elimination of the hard physical labour inseparable from present methods.

ELECTRIC GENERATORS

INSTALLATION. Procedure in Starting Up a New Generator, M. Phillips. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1089-1091, 3 figs. Mechanical and electrical inspection of newly-installed machine preparatory to starting it up; describes method of testing field pole insulation resistance.

LARGE, CONSTRUCTION OF. Improvements in Large Generator Construction, J. R. Taylor. Power Plant Eng., vol. 31, no. 19, Oct. 1, 1927, pp. 1045-1047, 5 figs. New skeletonized frame stator construction permits complete assembly and winding of 75,000-kw. stator before shipment.

WATER-WHEEL TYPE. Field Test of Propeller-Type Water-Wheel, G. E. Haggas. Elec. World, vol. 90, no. 15, Oct. 8, 1927, pp. 739-741, 4 figs. West Buxton unit of Cumberland County Power & Light Co. on Saco river develops 92.1 per cent efficiency at 82 per cent gate opening, thereby exceeding guarantee; record size of runner involved.

ELECTRIC GENERATORS, A.C.

SLOW-SPEED, HYDRAULIC. Large Slow-Speed Vertical Water-Wheel Generators Have Special Features, M. W. Smith. Power, vol. 66, no. 8, Aug. 23, 1927, pp. 284-285, 4 figs. Design feature of 40,000-kva. generators for Conowingo.

ELECTRIC GENERATORS, D.C.

OPERATION. How to Operate D.C. Generators at Voltages and Speeds Other Than Given on the Nameplate, C. B. Hathaway. Power, vol. 66, no. 10, Sept. 6, 1927, pp. 353-356, 5 figs. Changed operating conditions for direct-current generators and results.

ELECTRIC LOCOMOTIVES

MOTOR GENERATOR. Great Northern Electric Locomotives, R. Walsh. Ry. Age, vol. 83, no. 13, Sept. 24, 1927, pp. 569-572, 5 figs. Describes articulated, motor-generator type electric locomotive built by Gen. Elec. Co. for Great Northern Ry.; provide variable speed, regenerative braking and smooth acceleration for heavy grade line.

Motor-Generator Type Locomotives for Great Northern Railway, R. Walsh. Gen. Elec. Rev., vol. 30, no. 10, Oct. 1927, pp. 477-482, 6 figs. Single-phase a.c.-d.c. locomotives to handle present freight and passenger traffic; mechanical features of construction; electrical converting and driving equipment; control system and auxiliaries.

TRANSFORMERS. Air-Blast Transformers for Great Northern Locomotives, G. L. Mower. Gen. Elec. Rev., vol. 30, no. 10, Oct. 1927, pp. 483-484, 3 figs. Mechanical and electrical service requirements; unusual features of construction incorporated; compactness, strength and capacity combined; provision for varied operating conditions.

ELECTRIC MOTORS

STARTING. Controllers for Starting Synchronous Motors, J. H. Graybill and E. W. DeVeber. Power, vol. 66, no. 13, Sept. 27, 1927, pp. 472-475, 6 figs. Types of starters that have become standard for synchronous motors and kind of protection for these motors.

ELECTRIC MOTORS, A.C.

SUPER-SYNCHRONOUS. Features of the Super-Synchronous Motor. Power Plant Eng., vol. 31, no. 15, Aug. 1, 1927, pp. 828-829, 2 figs. Motor having both revolving stator and rotor combines in one machine good qualities of synchronous and induction motor.

ELECTRIC RAILWAYS

CONDUCTORS. Uninsulated Return Conductors for Electric Tramways, G. W. Stubbings. World Power, vol. 8, no. 45, Sept. 1927, pp. 118-125, 4 figs. States theory of potential distribution in uninsulated conductors, and examines provisions of Ministry of Transport official regulations to ascertain how far these are in accord.

ELECTRIC TRANSMISSION LINES

HIGH-TENSION. High-Tension Service for Industrial Customers, O. Bauhan. Elec. World, vol. 90, no. 14, Oct. 1, 1927, pp. 651-654, 4 figs. Looped circuits, automatic and semi-automatic protection at consumer's substations and company supervision of operation prove value.

OPERATION OF. Recent Studies of Transmission Line Operation, J. G. Hemstreet. Power Plant Eng., vol. 31, no. 20. Oct. 15, 1927, pp. 1092-1095, 7 figs. Investigation of operation on 140,000-v. system discloses valuable data on proper methods of construction.

RECLOSING EQUIPMENT. Use of Reclosing Equipment on A.C. Lines, A. E. Anderson. Power Plant Eng., vol. 31, no. 15, Aug. 1, 1927, pp. 825-828, 4 figs. Describes action of reclosing equipment by means of typical wiring diagram.

ELECTRIC WELDING

SPOT. Spot Welding of Dissimilar Metal, R. T. Gillette. Welding Engr., vol. 12, no. 9, Sept. 1927, pp. 45-47, 6 figs. Uses of spot welding process; comparison with other methods; electrode material for dissimilar metals; electrode shape for unlike thicknesses.

ELECTRIC WELDING, ARC

BUILDING CONSTRUCTION. An Arc Welded Residence, J. G. Dudley. Welding Engr., vol. 12, no. 9, Sept. 1927, pp. 51-53, 8 figs. Steel-framed building with all joints welded which offers many advantages over other types of building construction.

Arc-Welded Wind Bracing Connections, W. A. Hakin and R. G. Richards. Welding Engr., vol. 12, no. 9, Sept. 1927, pp. 40-44, 6 figs. Tests to determine capacity of a given connection under high bending moments, and to evolve requisite data for proper design.

Arc-Welding in Buildings, J. Matte. Jr. Am. Welding Soc.—Jl., vol. 6, no. 9, Sept. 1927, pp. 46-66, 25 figs. Paper describes a structural engineer's experiences in this field of welding and makes some suggestions which may be of assistance.

ELECTRICAL APPARATUS. Welded Parts Take the Place of Castings. Machy. (Lond.), vol. 30, no. 778, Sept. 8, 1927, pp. 713-716, 9 figs. Revolutionary changes made by General Electric Co. in construction of large electrical apparatus and of smaller machines, especially when only one or few are required; whereas castings were previously used to large extent for building equipment of these classifications, they have now been almost entirely displaced by members made up by arc-welding steel plates, slabs and structural shapes together.

ELEVATORS

DOORS, ELECTRIC CONTROL OF. Elevator Doors Operated Electrically. Power, vol. 66, no. 11, Sept. 13, 1927, pp. 392-393, 4 figs. Describes type of doors opened by power obtained from electric motor and closed by springs compressed during opening operation.

SPEED CONTROL. Multi-Speed Elevators (L'emploi de plusieurs vitesses dans les ascenseurs et monte-charges), E. Bouchinot. Génie Civil, vol. 91, no. 10, Sept. 3, 1927, pp. 221-225, 11 figs. General description of speed control of elevators and detailed description of Baudet, Donon and Roussel system using a.c. motors and combining with aid of auxiliary motors advantages of changing potential and varying field.

EVAPORATORS

CRACKING OF BRASS TUBES IN. Cracking of the Brass Tubes of Evaporators, Heaters and Evaporators, J. A. Maronier. Inst. Sugar Jl., vol. 29, no. 344, Aug. 1927, pp. 418-420. Translation (abridged) from an article published in the Archief, 1926, 34, no. 38, 1051-1082.

F

FILES

STEEL, MANUFACTURE OF. Manufacturing Files of Sheffield Steel, J. W. Walker. Can. Machy. & Mfg. News, vol. 38, no. 19, Oct. 6, 1927, pp. 19-24. Outlines steel employed in manufacture of files, processes through which they pass in forming, tempering and testing, and relative merits of various methods utilized.

FILTRATION PLANTS

HARTFORD, CONN. Hartford Filtration Plant Does Good Work, C. M. Saville. Water Wks. Eng., vol. 80, no. 19, Sept. 14, 1927, pp. 1331-1332. Deals with successful operation of filtration plant of Hartford, Conn., which is of slow sand type, and methods which have been adopted to secure efficient results from this style of water purification.

OAKLAND, CAL. The Upper San Leandro Filtration Plant of the East Bay Water Company, Oaklanld, California, W. F. Langelier. West. Constr. News, vol. 2, no. 19, Oct. 10, 1927, pp. 78-83, 11 figs. Construction details of project, which comprises a 16-billion gallon impounded reservoir, 7,150 ft. of tunnel and a 12 m.g.d. rapid sand filtration plant; work completed and plant placed in operation in April 1927.

FLOUR MILLS

MECHANICAL ENGINEERING IN. Mechanical Engineering in Flour Mill Operation, M. D. Bell. Mech. Eng., vol. 49, no. 10, Oct. 1927, pp. 1125-1128, 5 figs. Brief account of the mechanical engineer's relations to and accomplishments in the milling industry, which, for convenience, is divided into five major divisions: (1) grain storage and handling; (2) milling; (3) packing and loading; (4) mechanical department; (5) related activities.

FOUNDATIONS

CONCRETE. Foundation Work Hampered by Soft Ground and Seamy Rock, C. H. Dickinson. Eng. News-Rec., vol. 99, no. 11, Sept. 15, 1927, pp. 424-425, 2 figs. Difficulties encountered in sinking caissons or walls for concrete foundation columns at new Delray No. 3 power station of Detroit Edison Co., and how they were overcome; sulphur-water and gas, injurious to concrete, shut off by grouting; shaft lining jacked down in soft clay.

WET GROUND. Large Power House Foundation Built in Wet Ground. Eng. News-Rec., vol. 99, no. 13, Sept. 29, 1927, p. 511. Spread footings placed after blanketing sand with seal layer of concrete on tamped gravel to control flow of water.

FLOW OF AIR

BEHIND INCLINED FLAT PLATE. On the Flow of Air Behind an Inclined Flat Plate of Infinite Span, A. Fage and F. C. Johansen. Roy. Soc.—Proc., vol. 116, no. A773, Sept. 1, 1927, pp. 170-197, 7 figs. Investigation undertaken to determine experimentally, at incidences below 90 per cent, frequency and speed with which vortices pass downstream; dimensions of vortex system; average strength of individual vortices; and rate at which vorticity is leaving edges of plate. Plates 6-8.

FLOW OF GASES

RESISTANCE OF GRAINED MATERIALS TO. The Resistance of Materials to Gas Flow, L. K. Ramsin. Fuel, vol. 6, no. 9, Sept. 1927, pp. 411-415, 4 figs. Tests conducted to secure reliable data for designing drying plants and also to determine resistance of various fuel and slag beds in furnaces.

FLOW OF WATER

Pipes. Experiments on the Loss of Head in Pressure Conduits of Small Diameter (Recherches experimentales sur les pertes de charges dans les conduites forcées), C. Hanco. Révue Universelle des Mines, vol.l 115, no. 5, Sept. 1, 1927, pp. 202-219, 16 figs. Report on series of experiments, at the machine laboratory of the University of Liege, on steel and cast iron pipes of 20 mm. to 50 mm. diameter, analyzed largely on basis of the Reynolds formula; theoretical discussion of most economic velocity.

FOUNDRIES

Sand Control. Bottle Test for Sand Control. Iron Age, vol. 120, no. 12, Sept. 22, 1927, pp. 793-794. Crane Co., Chicago, keeps foundry losses down by close watch of sand; has only three kinds; standard, coarse, and one with high bond; bottle and vibrator test recommended.

FOUNDRY EQUIPMENT

Flask Grinding. New Machine for Surface Grinding of Flasks (Nouvelle machine pour dresser par meulage les chassis de fonderie). La Révue de Fonderie Moderne, vol. 21, Sept. 10, 1927, pp. 301-303, 3 figs. Construction and operation, advantages of grinding machine over planing and milling lathes generally used in foundries.

FURNACES, HEAT TREATING

Non-Continuous. Furnaces for Forging and Heat Treating, M. H. Mawhinney. Forging—Stamping—Heat Treating, vol. 13, no. 9, Sept. 1927, pp. 374-376. More important factors to be considered in selection of suitable non-continuous furnace for forging or heat treating miscellaneous pieces that are variable in size; among the features covered are design and construction, burners, fuel saving, insulation and automatic control of fuel.

Oil-Fired. Front Axles for Automobiles Uniformly Heated in Oil-Fired Furnace. Fuels & Furnaces, vol. 5, no. 9, June 1927, pp. 1215-1216, 2 figs. Furnace of the walking-beam type uniformly heats axles for stretching and flattening operations.

Refractory Linings. Refractory Linings for Forge and Heating Furnaces, M. C. Booze. Fuels and Furnaces, vol. 5, no. 9, Sept. 1927, pp. 1197-1198. Different types of refractories best adapted for certain kinds of service; all desirable properties not available in any one material and it is often desirable to use two or more refractories in combination to secure maximum service; open joints and flame impingement should be avoided; cracks should be repaired immediately.

FURNACES, HEATING

Electric vs. Fuel-Fired. Comparing the Economies of Furnaces, C. L. Ipsen and A. N. Otis. Can. Machy. & Mfg. News, vol. 38, no. 16, Sept. 15, 1927, pp. 13-16, 10 figs. Compares relative economies of electric and fuel-fired furnaces for various manufacturing purposes, and outlines means whereby economies might be secured in several types.

Gas-Fired. Testing the Efficiency of Gas-Fired Warm-Air Furnaces, G. B. Shawn. Heat. & Vent. Mag., vol. 24, no. 10, Oct. 1927, pp. 65-66 and 74, 2 figs. A new method developed at the Am. Gas Assn. testing laboratory solves troublesome problem of air measurement.

FURNACES, INDUSTRIAL

Efficiency. Industrial Furnaces, V. J. Azbe. Mech. Eng., vol. 49, no. 10, Oct. 1927, pp. 1079-1081, 6 figs. Importance of relative temperatures of heat-radiating and heat-absorbing media; effects on efficiency of low CO_2 and excess air; cost of steam for blowing.

G

GAS PRODUCERS

Sauvageot Grate for. Gas Producer Firing. Gas & Oil Power, vol. 22, no. 263, Aug. 4, 1927, p. 229, 2 figs. Describes Sauvageot grate, found particularly adaptable to use with gas producers; consists essentially of grate of peculiar construction, an air-box and mechanical drives.

GEAR CUTTING

Double-Helical Gear Generator. Ten-Foot Sunderland Double-Helical Gear Generator. Machy. (Lond.), vol. 30, no. 777, Sept. 1, 1927, pp. 689-691, 2 figs. Designed for cutting double-helical gears with continuous or staggered teeth up to 10 ft. diameter, 24 in. face, 1 diametral pitch or 3-inch circular pitch; but attachments may be supplied for cutting spur gears up to same dimensions, and at slow rate pitches up to 4-inch circular pitch; also spiral gears up to limited range of face and angle.

GEARS

Teeth, Strength of. Line Chart for Strength of Gear Teeth, J. Campbell. Machy. (Lond.), vol. 30, no. 777, Sept. 1, 1927, pp. 698-699. Alignment chart based on Lewis formulas for strength of gear teeth.

Tooth Machining and Measurement. Machining and Measuring Gear Teeth, E. Buckingham. Am. Mach., vol. 67, nos. 11 and 13, Sept. 15 and 29, 1927, pp. 419-422, 4 figs., and 497-498, 2 figs. Sept. 15: Cutting action of hobs and nature of hobbed surface; limitations of hobbing; shaping of gear teeth; height of fillet developed and other limitations. Sept. 29: Relieving pinion-shaped cutters; modification of pitch by change in cone angle of cutter; nature of shaped tooth surface and limitation of this method.

Worm. Novel Method Produces Pefect Fit Between Worm and Gear, K. W. Stillman. Automotive Indus., vol. 57, no. 16, Oct. 15, 1927, p. 583. Final finishing of Jordan gears is done with burnishing tool which is exact replica of standard worm; finish obtained is same as after 2,000 miles on road.

GLUES

Adhesive Strength of. Measurement of the Adhesive Strength of Glue, C. E. Lanyon. Indus. & Eng. Chem., vol. 19, no. 10, Oct. 1927, pp. 1191-1193. Test for measuring adhesive strength of glue and results obtained.

GRINDING MACHINES

Automobile Parts. A New Hydraulic Plain Grinder. Automobile Engr., vol. 17, no. 232, Sept. 1927, pp. 334-335, 2 figs. Machine is made in two models with capacities of 10 in. by 20 in. and 10 in. by 36 in., respectively, the larger type being that employed for crankshaft grinding; a high-power machine for traverse or in-feed work.

Disc. Twelve-Inch Disc Grinder. Mech. World, vol. 82, no. 2126, Sept. 30, 1927, p. 254, 1 fig. Description of machine recently built in engineering shops of Keighley Technical College.

H

HAMMERS

Steam. Driving Piles with a Steam Hammer, D. J. Emrey. Can. Engr., vol. 53, no. 10, Sept. 6, 1927, pp. 280-281, 4 figs. Method employed in place of pile-driver; iron collar with wire rope guys attached hold pile while being driven with McKiernan-Terry hammer; average depth of pile was 48 feet.

Lubrication of Steam Hammer, D. C. Price. Forging—Stamping—Heat Treating, vol. 13, no. 9, Sept. 1927, pp. 360-361, 2 figs. Difficulties encountered in lubrication of steam hammers and means for overcoming; oil should be filtered and heated.

HEAT TREATMENT

Automobile Springs. Heat Treatment of Automobile Springs in Electric Furnace. Fuels & Furnaces, vol. 5, no. 9, June 1927, pp. 1213-1214, 2 figs. Electrically heated furnace of the pusher type through which the springs are carried on short tubes pushed along in four parallel channels, has heating elements above and below the hearth.

Oxy-Acetylene Flame. Heat Treatment with the Oxy-Acetylene Flame, E. E. Thum. Am. Welding Soc.—Jl., vol. 6, no. 9, Sept. 1927, pp. 95-101, 7 figs. Advantages and possibilities of oxy-acetylene flame for heat treatment.

HEATING AND VENTILATION

Schools. Heating and Ventilating a Large High School. Power Plant Eng., vol. 31, no. 19, Oct. 1, 1927, pp. 1050-1052, 4 figs. Unit heaters and ventilating equipment, under complete thermostatic control in conjunction with steam radiators supplied from modern boiler plant, maintain proper temperatures and fresh air in new Cleveland Heights high school.

HEATING, ELECTRIC

Low-Temperature. Low-Temperature Electric Heating, M. P. Whelen. Can. Machy. & Mfg. News, vol. 38, no. 18, Sept. 29, 1927, pp. 13-16, 11 figs. Growth in use of electric heating devices in home and factory in past ten years has been so phenomenal that few executives and engineers appreciate as yet opportunities now available for improving manufacturing methods and working conditions.

HEATING, HOT WATER

Duplex. Interesting Example of Duplex Hot Water Heating, T. F. Moffett. Plumbers' Trade Jl., vol. 83, no. 7, Oct. 1, 1927, pp. 671-673, 6 figs. Full layout for actual installation shows essential technical features.

HEATING, HOUSE

Gas. House Heating with Manufactured Gas in Canada, R. J. Percival. Gas Engr., vol. 43, no. 617, Sept. 1927, pp. 226-227. General description of using manufactured gas for house heating; relation of insulation to house heating with gas.

HEATING, STEAM

Central. Heating Plants Have Difficult Water Problems. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1079-1081, 2 figs. Laboratory conclusions and operating results of feedwater treating system of Beacon St. Central Heating Plant; zeolite was final selection; acid treatment follows zeolite tanks; no scale found after several months' operation.

Intermittent. A Study of Steam Control in an Intermittently-Heated Office Building, W. J. Baldwin. Heat. & Vent. Mag., vol. 24, no. 9, Sept. 1927, pp. 81-82. Analysis of steam demand of typical office building recently was made as result of data collected during thirty-two different days of last heating season; steam, supplied from mains of New York Steam Corp., was fed to building by device known as Pendleton control.

Schools. Ripping Out Furnaces and Installing a Steam Heating System in a Sixteen-Room School Building, T. N. Thomson. Plumbers' Trade Jl., vol. 83, no. 7, Oct. 1, 1927, pp. 674-677, 8 figs. New steam heating and ventilating system was laid out and installed in Potter Street School Building, Utica, N.Y.; utilizing old furnace heat flues for ventilation; installing radiators in classrooms.

Variable-Pressure. Sectional Control of Variable Steam Pressure, H. L. Alt. Heat. & Vent. Mag., vol. 24, no. 9, Sept. 1927, pp. 65-69, 8 figs. Consideration of various methods of dividing building to secure highest operating efficiency; discussion is limited to vacuum steam systems operating in large buildings, with steam pressures in radiators controlled by boiler room or at least from basement; so that pressure in radiators can be varied at will from 2 lb. gauge to 22 in. or 25 in. of vacuum, thereby controlling heat emitted from radiators from normal down to about 50 per cent of normal.

HYDRAULIC PRESSES

Tire Removal. Hydraulic Presses for Fixing and Removing Wheel Tires. Mech. World, vol. 82, no. 2126, Sept. 30, 1927, pp. 235-236, 3 figs. Equipment manufactured by Hollings & Guest, Ltd., for fixing and removing solid tires.

HYDRAULIC TURBINES

Testing. Hydro Turbine Tests—Pitot and Venturi Tubes. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1086-1088, 6 figs. Multiple pitot tube method offers many advantages over single tube, while venturi is only test method giving continuous record of flow; camera used to get instantaneous readings.

HYDRO-ELECTRIC DEVELOPMENTS

Bryson, Quebec. The Bryson Hydro-Electric Power Development, H. E. Pawson. Eng. Jl., vol. 10, no. 10, Oct. 1927, pp. 459-467, 7 figs. Features of hydro-electric power development constructed on Calumet channel of Ottawa river near Bryson, Que., by Ottawa River Power Co.

California. Power and Irrigation Combined in Melones Development, E. A. Crelin. Elec. World, vol. 90, no. 13, Sept. 24, 1927, pp. 605-607, 6 figs. Pacific Gas & Electric Company builds power plant and pays irrigation districts' water rental; low load factor and block-load operation dictated simplicity and economy.

Connecticut. More Power for Connecticut. Constr. Methods, vol. 9, no. 10, Oct. 1927, pp. 22-25, 8 figs. Brief description of Rocky river development in northwestern Connecticut which will utilize flood waters of Housatonic river.

Deerfield River. Adequate Equipment Speeds 10,000-H.P. Hydro-Electric Development on Deerfield River, L. Gurney. Contractors' Rec. & Eng. Rev., vol. 15, no. 2, Aug. 1927, pp. 71-74, 6 figs. Shovels, pumps, cement mixers, derricks, trucks, hydraulic and electrical equipment used in Sherman hydro-electric development.

Hemmings Falls, Canada. Hydro Development at Hemmings Falls. Can. Engr., vol. 53, no. 11, Sept. 13, 1927, pp. 289-294, 7 figs. Southern Canada Power Co.'s development on the St. Francis river near Drummondville, Que.; six 5,000-h.p. turbines installed driving two 30-cycle and four 60-cycle generators; details of concrete construction and equipment.

HYDRO-ELECTRIC PLANTS

Conowingo. Conowingo. G. R. Strandberg. Elec. Light & Power, vol. 5, no. 10, Oct. 1927, pp. 26-30, 9 figs. Distinctive features of construction of Conowingo hydro-electric plant on Susquehanna river: power will be transmitted to Philadelphia and distributed by Philadelphia Elec. Co.

Economies in. Large Economies Result from Using Steam Turbine Loading Schedules, A. R. Haynes. Power, vol. 66, no. 13, Sept. 27, 1927, pp. 462-465, 5 figs. Study of operating schedule built up from water rates of units; typical case of station with four units is assumed, and operating data plotted to show characteristics of units and most efficient combination of loads.

Heating and Ventilating in. Heating and Ventilating Problems in the Modern Power Plant, C. L. Hubbard. Nat. Engr., vol. 31, no. 9, Sept. 1927, pp. 411-416, 7 figs. Design and construction problems involved in the proper heating and ventilating of the modern power plant to insure maximum comfort to the operators and maximum reliability of operation.

Penstocks, Fastening. Concrete Anchors Hold Penstocks to Mountain Side. Contractors & Engrs. Monthly, vol. 15, no. 3, Sept. 1927, pp. 77-79. Unusual construction problems arise in building penstock to operate under highest head in America; shows method of anchoring power house and switching rack.

I

ICE PLANTS

Aerating Equipment. Moisture in Aerating Systems, W. H. Motz. Refrigeration, vol. 42, no. 3, Sept. 1927, pp. 46-47. Effects of temperatures and pressures upon deposit of moisture by air in passing through air piping of aerating equipment of raw water ice plants.

Auxiliary Compressors. The Auxiliary Compressor, T. Mitchell. So. Power Jl., vol. 45, no. 9, Sept. 1927, pp. 44-46, 4 figs. Modern reliability and efficiency demand auxiliary equipment in the ice plant; reliability, that continuous service be rendered through the safeguard of a standby unit, and, efficiency, that flexibility and high load factor for individual machines be made possible.

Diesel Engines in. Diesel Oil Engine Replaces Electric Drive. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1104-1105, 4 figs. Wiskow Ice Mfg. Co. of Baltimore substitutes oil engine power for public service power in ice plant; port scavenging under pressure removes burnt gases; precombustion chamber forms rich explosive mixture.

Management. Fundamentals in the Management of an Ice Plant, E. W. Davies. So. Power Jl., vol. 45, no. 9, Sept. 1927, pp. 52-53, 2 figs. Eternal vigilance and attention to detail essential, proper instruments for measuring economy and operation pay high dividends, and labour-saving devices adapted to the size and character of the plant add to the net return.

ICE MANUFACTURE

Quality vs. System. Cracked Ice or Clear Ice—Which Have You? H. A. Cranford. So. Power Jl., vol. 45, no. 9, Sept. 1927, pp. 62-64, 8 figs. Cracked ice the result of rapid and considerable temperature changes; its prevention depends upon better control of this factor, as dictated by the system used.

IMPACT TESTING

Repeated Impact. A Testing Machine for Repeated Impact, and a Preliminary Investigation on the Effects of Repeated Impact on Lowmoor Iron, J. H. Smith and F. V. Warnock. Iron & Steel Inst.—Advance Paper, no. 13, Sept. 1927, 33 pp., 10 figs. Investigation of effect of tensile or compressive impact when applied repeatedly in such a manner that energy given to specimen is known; description of impact-testing machine used; Lowmoor iron used for experiments; contains 99.617 per cent iron and small percentages of silicon, phosphorus, sulphur, manganese and carbon.

INDUSTRIAL MANAGEMENT

Overcapacity. Overcapacity: Problem or Opportunity? E. N. Hurley. Factory, vol. 39, no. 3, Sept. 1927, pp. 407-411. States that manufacturers who increase investments materially in order to reduce costs are employing one of surest methods for increasing present profits and assuring future stability.

Production Equipment Maintenance. Keeping the Production Equipment in Trim, C. S. Gotwals. Indus. Mgmt. (N.Y.), vol. 74, no. 3, Sept. 1927, pp. 174-176. Plant of Hess-Bright Mfg. Co. develops practical programme for maintenance of production equipment based on objective of maximum production with minimum cost.

Quantity Production. Quantity Manufacturing and Testing of Industrial Control Devices, G. H. Dorgeloh. Gen. Elec. Rev., vol. 30, no. 10, Oct. 1927, pp. 485-487, 7 figs. Preliminary considerations for mass production; progressive assembly system; steps in manufacture of compensators; testing temperature overload relays.

Time Study. *See Time Study.*

INSULATION, HEAT

Economy. Money Saved by Heat Insulation, L. M. Arkley. Contract Rec. & Eng. Rev., vol. 41, no. 37, Sept. 14, 1927, pp. 931-933 and 943, 1 fig. Means to conserve heat and prevent its dissipation are simple and inexpensive when compared with the savings due to lower radiation required and reduced fuel cost.

Houses. Insulating Materials and Their Various Properties. Heat. & Vent. Mag., vol. 24, no. 10, Oct. 1927, pp. 88-89. A report to the American Gas Association by the sub-committee of its house heating committee.

INTERNAL COMBUSTION ENGINES

See Airplane Engines; Automobile Engines; Diesel Engines; Oil Engines.

IRON ALLOYS

Aluminum, Effect of. The Influence of Aluminum on an Iron-Carbon Alloy, A. B. Everest. Foundry Trade Jl., vol. 36, no. 575. Aug. 25, 1927, pp. 169-173, 9 figs. Describes preliminary investigation at Univ. of Birmingham; results indicate range of alloys which might be investigated in further detail with view to their commercial application.

Case Hardening. Case Hardening of Ferrous Alloys with Vanadium and with Cobalt (Cementation des alliages ferreux par le vanadium et par le cobalt), J. Laissus. Révue de Metallurgie, vol. 24, no. 8, Aug. 1927, pp. 474-484, 15 figs. Theoretical and experimental study showing that hardening with either of these metals produces a superficial layer whose thickness can be increased by raising temperature or prolonging treatment, which resists corrosion by water and acids.

Iron-Nickel. The Influence of Nickel and Silicon on an Iron-Carbon Alloy, A. B. Everest, T. H. Turner and D. Hanson. Iron & Steel Inst.—Advance Paper, no. 4, Sept. 1927, 29 pp., 31 figs. Account of investigation to obtain information concerning fundamental action of nickel by studying its effect on simple iron-carbon-silicon alloys, before proceeding to the investigation on more complex cast irons, in which other elements always occur.

Silicon-Carbon. The Constitution of Silicon-Carbon-Iron Alloys and a New Theory of the Cast Irons, D. Hanson. Iron & Steel Inst.—Advance Paper, no. 6, Sept. 1927, 41 pp., 16 figs. Investigation carried out by author for Cast Iron Research Association on ternary alloys of iron containing 0 to 2 per cent of silicon and 0 to 4 per cent of carbons, it is shown that in ternary alloys, graphite and cementite can occur as stable phases, either separately or together, and limits of temperature and composition within which each occurs have been determined; theory of cast iron is developed with reference to ternary equilibrium of this alloys system, and is used to account for principal features of commercial iron carbon alloys.

J

JOINTS

Structural Steel. The Rational Design of Structural Steel Joints for Arc-Welded Connection, A. M. Candy. Engrs. & Eng., vol. 44, no. 8, Aug. 1927, pp. 204-211, 21 figs. Results of tests of 42 specimens indicate that absolute fixation can be obtained between beams and girders, or beams and columns; lines of beams, or lines of girders, can be made continuous throughout their supports; wind bracing may be reduced; steel savings will be increased; corrosion will be lessened, etc.

L

LACQUERS

Modern. Modern Solvents and Lacquers, H. W. Haines. Chemicals, vol. 28, no. 13, Sept. 26, 1927, pp. 7-9. Lacquers and varnishes compared; speed in lacquer application; durability, constituents and uses in present-day industry.

LATHES

Arbours. The End Clamping Details of Turning Arbours. Mech. World, vol. 82, no. 2123, Sept. 9, 1927, pp. 184-185, 9 figs. Discussion of new kinds of nuts and end-pressure devices for lathes.

Cam-Turning. Turning Camshafts. Automobile Engr., vol. 17, no. 232, Sept. 1927, p. 338, 1 fig. Machine in which cutting element is a turning tool in its simplest form; designed for rough and finish-turning contour of any number of cams simultaneously.

Railway Wheel. Motor-Driven Heavy Duty Railway Wheel Lathe. Machy. (Lond.), vol. 30, no. 781, Sept. 29, 1927, pp. 810-811, 3 figs. Motor-driven 20-inch centre railway wheel lathe recently constructed by John Hetherington & Sons, Ltd., Manchester, is capable of turning both wheels simultaneously, mounted on their axle, up to 30 in. diameter on tread and down to a minimum diameter of 24 in.

Single-Point Profile Turning in. Single-Point Profile Turning. Mech. World, vol. 82, no. 2126, Sept. 30, 1927, pp. 238-239, 6 figs. Describes methods of single-point generation of profiles by means of which cutting can proceed at about ordinary speeds and feeds and result in good finish without chatter or deep scratches.

LEAD ALLOYS

Lead-Tin. Effect of Work and Annealing on the Lead-Tin Eutectic, F. Hargreaves. Engineering, vol. 124, no. 3218, Sept. 16, 1927, pp. 375-376. Experiments made to determine relationship between amount of softening action resulting from work at air temperature on specimen of lead-tin eutectic, and degree of working; effect of annealing at different temperatures for varying periods also determined.

LIGHTING

Factories. Rewires Factory for Better Lighting, J. M. Ketch and L. R. Bogardus. Elec. World, vol. 90, no. 14, Oct. 1, 1927, pp. 695-698. Packard Motor Car Co. revamps its lighting system; use of newly developed square conduit gives unusual flexibility to wiring.

Streets. Importance of Post Spacing in Street Lighting, F. H. Murphy. Elec. World, vol. 90, no. 13, Sept. 24, 1927, pp. 609-611, 4 figs. Study of system proposed to reduce cost shows inadequacy of illumination at street intersections; comparison made of three systems for lighting business streets in Portland, Ore.

LOCOMOTIVE BOILERS

Repaired by Welding. Autogenous Welding Used to Repair Locomotive Boilers (Application de la soudure autogene à la réparation des chaudières-locomotives), M. E. Renaud. Revue Génerale des Chemins de Fer, vol. 46, no. 9, Sept. 1927, pp. 248-262, 24 figs.

LUBRICANTS

Automotive. Automotive Lubricants, L. W. Parsons. Indus. & Eng. Chem., vol. 19, no. 10, Oct. 1927, pp. 1116-1119. Contribution of chemistry to development of automotive lubricants; the refining of crude oil to make satisfactory lubricants for automotive purposes; properties of lubricating oils; lubrication theory and composition of lubricants; variety of lubricants; lubrication of airplanes, motor-driven ships and submarines; changes in properties of lubricants in service; lubrication research projects.

Gas Engines and Compressors. Fundamentals of Correct Lubrication, A. J. Turner. Oil & Gas Jl., vol. 26, no. 19, Sept. 29, 1927, p. 172. Proper oils for natural gas engine and compressor lubrication; definite operating factors considered.

Greases, Properties of. Properties of Greases and Their Use for Lubrication, H. L. Kauffman. Eng. World, vol. 31, no. 3, Sept. 1927, pp. 162-164. Outstanding advantages of grease lubrication; kinds of greases; applying; grease cups;

LUBRICATING OILS

Coals, as Source of. Lubricating Oils from Coals. H. Nielsen and S. Baker. Mech. Eng., vol. 49, no. 10, Oct. 1927, pp. 1109-1110, 5 figs. Methods of preparation of lubricating oil from coal oil and report of tests of two samples, one distilled from coal and the other from a straight mineral oil.

Testing. A Machine for Testing Lubricating Oils and Anti-Friction Alloys (Machine à essayer les huiles de graissage, les bronzes et alliages antifriction de la Compagnie des Chemins de Fer de l'Est). Societé d'Encouragement pour l'Industrie Nationale, vol. 126, no. 6, June 1927, pp. 444-449, 6 figs. Describes machine developed by leading French railway company, recording friction coefficients, temperatures, etc., of lubricating or anti-friction materials, which are supplied by standard pad to standard journal-bearing running at prescribed velocity.

LUBRICATION

Steam Cylinders. Theory and Practice of Steam Cylinder Lubrication. Lubrication, vol. 13, no. 8, Aug. 1927, pp. 85-96, 19 figs. Consideration of operating conditions which must be met by cylinder oil; requirements of specific types of engines; types of lubricants and method of application; types of lubricators and principles involved in delivery; super-heat conditions; determination of effective lubrication.

M

MACHINE SHOPS

Scraping, Hand. Supplanting Hand Scraping with Grinding. Am. Mach., vol. 67, no. 14, Oct. 6, 1927, pp. 535-536, 3 figs. Accurate results in grinding at plant of Bullard Machine Tool Co. show that all hand scraping can be done away with where amount of scraping justifies expense.

MACHINE TOOLS

Automotive. Machine Tools for Automotive Use Predominate at Cleveland Show, E. B. Neil and K. W. Stillman. Automotive Indus., vol. 57, no. 14, Oct. 1, 1927, pp. 492-499. Unusually large number of new designs exhibited; new trends revealed.

Crankpin Manufacturing. Crankpin Turning, Grinding, Boring and Quartering Machine. Machy. (Lond.), vol. 30, no. 780, Sept. 22, 1927, pp. 791-792, 3 figs. Describes machine designed for boring crankpin holes in locomotive wheels, either straight or tapered, and for turning and grinding crankpins at true quartered centres; constructed by John Holroyd & Co., Ltd.; feature of machine is patent automatic reversing adjustable feed which makes overrunning of grinding wheel impossible.

Exhibitions. New Abrasive Developments May Be Studied at Machine Tool Show. Abrasive Industry, vol. 8, no. 10, Oct. 1927, pp. 310-319, 15 figs. Brief description of few new grinding machines shown for first time at National Machine Tool Builders' Exposition held in Cleveland, Sept. 19-23.

Keyseating Fixtures. Fixtures and Gauges for Cutting Woodruff Keyseats. Machy. (Lond.), vol. 30, no. 780, Sept. 22, 1927, pp. 783-784, 5 figs. Automobile industry requires thousands of shafts, from 6 to 12 in. long, with Woodruff keyseats near ends; article describes several types of satisfactory fixtures for gripping shafts in chuck to hold and index them when cutting keyseats.

Replacement Policy. Profits from New Machine Equipment, F. C. Hudson. Am. Mach., vol. 67, no. 15, Oct. 13, 1927, pp. 583-584. Outlines methods pursued by management of good sized shop in buying machinery for building diversified line of fairly large machinery.

MACHINERY

TORONTO SHOW. Steel and Power Show Proves Triumph. Can. Machy. & Mfg. News, vol. 38, no. 17, Sept. 22, 1927, pp. 21-34. Review of Canada's First Steel and Power Show, held at Toronto, Aug. 21, Sept. 1 and 2; technical sessions; arrangement of exhibitions; list of equipment and products on display.

MAGNESIUM ALLOYS

MAGNESIUM-CADMIUM. The System Magnesium-Cadmium, W. Hume-Rothery and S. W. Boswell. Inst. of Metals—Advance Paper, no. 445, 1927, 18 pp., 9 figs. Equilibrium diagram of the system magnesium-cadmium investigated by thermal and microscopic methods; prolonged annealing is necessary to attain equilibrium in the solid alloys in the neighbourhood of the compound $MgCD_2$.

MATERIALS HANDLING

EQUIPMENT MAINTENANCE. Keeping Up the Equipment That Handles the Work, K. D. Hamilton. Factory, vol. 39, no. 3, Sept. 1927, pp. 421-423. Discusses such essentials as inspection, lubrication and protection for maintenance of materials handling equipment in various lines of work.

FACTORIES. Methods of Solving Material Handling Problems, D. B. Kift. Indus. Eng., vol. 85, no. 9, Sept. 1927, pp. 397-400, 5 figs. Steps taken by Edison Electric Appliance Co., Inc., Chicago, to overcome difficulties in handling various materials in plant manufacturing electric ranges and refrigerators and other electric household appliances.

MISCELLANEOUS ITEMS. Less Direct Labour Cost by Mechanical Handling, E. Lilly. Factory, vol. 39, no. 3, Sept. 1927, pp. 529-540. Adapting conveyors to handle relatively small lots of many different items.

MEASUREMENTS

LENGTH STANDARDS. Testing of Line Standards of Length. U.S. Bur. Standards—Dept. of Commerce, no. 232, May 13, 1927, 22 pp., 2 figs. Outlines methods used in comparison and standardization of line standards of length and gives basis of such measurements in United States; apparatus used and precautions necessary for precise work are considered; information regarding testing of line standards and of metal tapes is given, including shipping directions.

METALS

GRAIN GROWTH. Grain Growth in Compressed Metal Powder, C. J. Smithells, W. R. Pitkin and J. W. Avery. Inst. of Metals—Advance Paper, no. 441, 1927, 13 pp., 15 figs. Investigation of changes which take place in certain properties of bars of pressed tungsten powder when temperatures are gradually raised; these changes are attributed to grain growth, which is shown to begin at a temperature determined by the particle size of the powder and the pressure used in forming the bar.

STRENGTH AT HIGH TEMPERATURES. Experimental Researches on the Speed of Deformation of Metals at High Temperatures (Recherches expérimentales sur les vitesses de déformation des métaux aux hautes températures), P. Henry. Revue de Métallurgie, vol. 24, no. 8, Aug. 1927, pp. 421-442, 16 figs.

MICROMETERS

SCREW. The Metric-Inch Micrometer. Model Engr. & Light Machy. Rev., vol. 57, no. 1373, Sept. 1, 1927, pp. 202-203, 3 figs. Describes combination of metric and inch micrometer instrument which as a whole is considered accurate within satisfactory limits, calibration of screw for progressive error at intervals of 0.1 in. over its 1 in. of length showed it to be within 0.0001 of an inch total, and within 0.003 mm. by metric measure.

MOULDS

SAND BLACKING. Blacking Sand Moulds, J. Dean. Foundry Trade Jl., vol. 36, no. 576, Sept. 1, 1927, p. 196. Utility of blacking mixtures; mixing blacking; sprayer for blacking.

MOTOR BUSES

DESIGN. Passenger Comfort and Handling Improved in Latest Body Development. Bus Transportation, vol. 6, no. 10, Oct. 1927, pp. 561-565, 18 figs. Fageol Coach Co. adopts frameless design which, instead of having a chassis frame and a foundation almost as heavy supporting the body, the "live" parts of the chassis are attached to the body structure, making latter sufficiently heavy and strong; other novel design features.

Steady Progress Features Construction, R. E. Plimpton. Bus Transportation, vol. 6, no. 10, Oct. 1927, pp. 558-560, 12 figs. Changes in design to increase revenue and reduce cost; chassis and components; body and fittings.

The Trend of Bus Design, D. Blanchard. Operation and Maintenance, vol. 36, no. 3, Sept. 15, 1927, pp. 11-13, 12 figs. More economical operation, higher average operating needs, increased riding comfort and improved appearance continue to be the main objectives of bus design development work.

N

NICKEL STEEL

NICKEL-CHROMIUM. Magnetic and Other Changes Concerned in the Temper-Brittleness of Nickel-Chromium Steels, H. A. Dickie. Iron & Steel Inst.—Advance Paper, no. 2, Sept. 1927, 16 pp., 10 figs. Account of experiments carried out to discover how the magnetic properties, the specific electrical resistance, the specific volume and the hardness of highly susceptible nickel-chromium steels are affected by various tempering treatments.

NON-FERROUS METALS

TENSILE TEST BARS. Methods for Gating Tensile Test Bars of Sand-Cast Non-ferrous Alloys, R. J. Anderson. Foundry Trade Jl., vol. 36, no. 18, Aug. 18, 1927, pp. 159-161, 10 figs. Various tests were made by writer with gating methods on a large number of commercial casting brasses, bronzes and aluminum alloys, excepting high-shrinkage brasses of the type of aluminum brass and manganese bronze.

O

OIL ENGINES

AIRLESS-INJECTION. Airless Injection and Combustion of Fuel in the High Compression Heavy Oil Engine, D. H. Alexander. Inst. Mar. Engrs.—Trans., vol. 39, Aug. 1927, pp. 366-414, 30 figs. Investigation of working of "controlled pump" or "intermittent pressure" type of oil-fuel injection carried out at Cambridge University by author.

AUTOMOTIVE. What is the Automotive Future of the Oil Engine. Oil Engine Power, vol. 5, no. 10, Oct. 1927, pp. 676-677, 1 fig. Use of oil engines for automotive service in Europe; comparison of operating cost of Diesel and gasoline trucks.

COOLING-WATER AND SCALE FORMATION. Treatment of Scale Formation in Oil Engine Power Plant, A. B. Newell. Nat. Engr., vol. 31, no. 9, Sept. 1927, pp. 433-435. Factors affected by water supply; effects of excessively low engine temperature; removing scale from engines; elimination of scale formation.

FUEL SUPPLY. The Future Supply of Suitable Fuels for Oil Engines, G. H. Miehler. Mar. News, vol. 14, no. 5, Oct. 1927, pp. 82-84 and 144. Author discusses various phases of fuel-supply problem and states that he can see no reason to doubt that there will be in future an adequate supply of oil suitable for Diesel engines to take care of even growing demand, nor is there any justifiable reason to feel price will go above level where Diesel engines can favourably compare with steam machinery burning coal.

OPEN-HEARTH FURNACES

REGENERATORS FOR. Regenerators for Open Hearth Furnaces, F. H. Loftus. Blast Furnace & Steel Plant, vol. 15, no. 9, Sept. 1927, pp. 438-440, 2 figs. Form of checker installation described has as its objective increased efficiency, less regenerator space, reduction in cost of upkeep and fewer shutdowns.

OXY-ACETYLENE WELDING

HEATING SYSTEMS. Oxy-Acetylene for the Heating Trade, J. L. Musgrave and W. A. E. Taylor. Acetylene Jl., vol. 29, no. 3, Sept. 1927, pp. 109-112, 13 figs. Shows that the gas-welding process may play an important part in the construction of heating systems.

P

PAPER INDUSTRY

ELECTRICITY IN. Electrical Measurements in Industry, A. L. Beedle. Iron & Steel of Can., vol. 10, no. 9, Sept. 1927, pp. 278-280. Electricity cost in a paper mill, where power is used or lost, essential electrical instruments, etc.

PERMEAMETERS

CAMBRIDGE. The Cambridge Magnetic Bridge Permeameter. Sci. Instruments—Jl., vol. 4, no. 11, Aug. 1927, pp. 357-360, 2 figs. Instrument is of bar and yoke type, and utilizes principle of eliminating joints by bringing two portions of test specimen to equal magnetic potential.

PIERS

GRAIN. Narrow Grain Pier Built to Form Unit of Future Pier, H. W. Frith. Eng. News-Rec., vol. 99, no. 14, Oct. 6, 1927, pp. 550-552, 3 figs. Square foundations of conveyor towers so placed that intermediate sections may be added to form one pier wall.

PUGET SOUND NAVY YARD. Sea Water Structure Constructed with Aluminous Cement Concrete Foundations, W. F. Way. Concrete & Constr. Eng., vol. 22, no. 9, Sept. 1927, pp. 533-542, 9 figs. Describes construction of pier no. 6 for repair and fitting out work at Puget Sound Navy Yard; designed for a uniform live load of 900 lb. per sq. ft. for all areas except that portion adjacent to the 350-ton stationary crane, where load was increased to 1,200 lb. per sq. ft.

PIPE

JOINTS. Using Lead Wire in Making Pipe Joints, W. W. Brush. Water Wks. Eng., vol. 80, no. 19, Sept. 14, 1927, pp. 1329-1330. Describes use of lead wire and lead wool in combination in repair of an underwater leak in large supply main; exposed position of big submarine pipe made job all more difficult.

PIPING

SYSTEMS. Scheme for the Identification of Piping Systems. Mech. Eng., vol. 49, no. 10, Oct. 1927, pp. 1144-1146. A systematic plan employing colour and other kinds of markings based on fundamental principles. From Recommended American Practice proposed by the Sectional Committee on the Identification of Piping Systems, organized under the procedure of the American Engineering Standards Committee; sponsored by the National Safety Council and The American Soc. of Mech. Engrs.

PLANERS

REVERSING DRIVE. Reversing Planing Machine Drive. Machy. (Lond.), vol. 30, no. 780, Sept. 22, 1927, pp. 789-790, 2 figs. Describes Niles-Bement-Pond planing machine with super control by means of which planer motor is quickly and smoothly reversed without the necessity of using an automatic controller; this form of control will work equally well on alternating and direct current.

POWER FACTOR

CORRECTION. Condensers for Power Factor Correction. Engineer, vol. 144, nos. 3739 and 3740, Sept. 9 and 16, 1927, pp. 286-287 and 314-316, 19 figs. Elementary discussion of meaning of power factor and need for correcting devices; types of condensers.

POWER GENERATION

HEAT-PUMP PRINCIPLE. Combined Production of Heat and Cold (Interêt et possibilité d'utiliser l'energie à la production combinée de chaleur et de froid utilisables), M. Lebre. Société des Ingenieurs Civils de France—Memoires, vol. 80, no. 5, May 1927, pp. 669-708, 8 figs. Discusses theory and possible practical applications of the principle of the heat pump—liquefying cold air and later letting it expand in warmer air; foresees possibility of combining and uniting work of ventilating, heating and refrigerating in one plant by means of electrical apparatus.

POWER TRANSMISSION

VARIABLE SPEED. Grooving Machine for Coned Wheels. Engineer, vol. 144, no. 3739, Sept. 9, 1927, p. 280, 3 figs. In the practical production of the positive, infinitely variable change-speed gear, one of the chief manufacturing problems to be overcome was to devise a satisfactory method of forming the teeth on the faces of the conical plates between which the self-pitching chain has to run.

PULVERIZED COAL

BURNING, METHODS FOR. Considerations in Changing to Powdered Coal, L. C. Fessenden. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1082-1083. When being substituted for stokers or hand firing successful operation of pulverized fuel burning equipment depends to large extent upon consideration given to making proper installation; two methods employed in burning pulverized coal, bin or storage type and unit pulverizer.

PUMPING STATIONS

DESIGN. Modern Waterworks Pumping Station Design and Its Future Trend, A. L. Mullergren. Contract Rec. & Eng. Rev., vol. 41, no. 36, Sept. 7, 1927, pp. 913-917. Improvements that have taken place in the equipment and operation of steam plants; tendency is toward higher pump capacities; developments in electrical installations.

PUMPS

TANGENTIAL. Use and Production of Tangential Pumps, D. M. Duncan. Can. Machy. & Mfg. News, vol. 38, no. 15, Sept. 8, 1927, pp. 11-12, 3 figs. Compares fields of reciprocating and centrifugal pumps and indicates intermediate position held by tangential pump in handling small volumes at high pressure.

TYPES. Modern Pumping Equipment, F. J. Taylor. Mech. World, vol. 82, no. 2126, Sept. 30, 1927, pp. 241-253. 25 figs. Review of modern pumping practice, with description of different types of pumps and methods of operation and control.

PUMPS, CENTRIFUGAL

SELECTION OF. The Selection of Centrifugal Pumps for Various Duties, G. A. Pullen. Domestic Eng. (Lond.), vol. 47, nos. 8 and 9, Aug. 1927 and Sept. 1927, pp. 156-164 and 182-188, 16 figs and 11 figs. Aug.: General principles; some types of pumps; pumps in series and parallel; suction; priming; discharge; velocity head. Sept.: Testing: measurement of speed and power; pumping liquids other than water; comparison of centrifugal and displacement pumps.

R

RADIATORS

DESIGN. Radiator Design, K. Meier. Domestic Eng., vol. 120, no. 11, Sept. 10, 1927, pp. 28-29, 5 figs. Development of radiators; problem of heat distribution.

GAS-FIRED STEAM. Gas-Fired Steam Radiators, H. T. Hall. Domestic Eng. (Chicago), vol. 120, no. 12 and vol. 121, no. 2, Sept. 17 and Oct. 8, 1927, pp. 22-24 and 24-26 and 67, 8 figs. Sept. 17: Data on initial and operating costs of gas-steam radiators. Oct. 8: Use of gas-fired steam radiators in shops, loft buildings, apartments and churches.

RADIOTELEGRAPHY

LABORATORY. A Wireless Works Laboratory, P. K. Turner. Instn. of Elec. Engrs.—Jl., vol. 65, no. 369, Sept. 1927, pp. 881-896 and (discussion) 896-902, 28 figs. Details of the equipment of a laboratory devoted to the problems of broadcast reception; among special equipment developed are: Galvanometer lamps; a distribution system for battery d.c. supply; elaborate valve tester; audio source; standard valve voltmeter; combined a.c. and d.c. bridge; and interchangeable high-frequency resistors; special methods are described in connection with insulation tests of condensers; correction of wattmeter errors; measurement of amplification; self-capacity of coils and their high-frequency resistance; and keeping records.

FREQUENCY CHANGERS. A New Frequency Transformer or Frequency Changer, I. Koga. Inst. of Radio Engrs.—Proc., vol. 15, no. 8, Aug. 1927, pp. 669-678, 13 figs. How to obtain 1/2, 1/3, etc., of frequency of given alternating current by means of three-electrode vacuum tube; same scheme can also be used as a frequency multiplier, and even to get frequencies such as 3/2, 2/3, 4/3, 3/4, etc., of a given frequency.

TRANSFORMERS. Audio Frequency Transformers, J. M. Thomson. Inst. of Radio Engrs.—Proc., vol. 15, no. 8, Aug. 927, pp. 679-686, 6 figs. Method for calculating amplification curve of an audio frequency transformer is developed in terms of usual constants of transformer and of tube; distributed capacity of coils and mutual capacity between primary and secondary coils are represented by lumped capacities; exciting current of transformer is neglected; an equation for amplification in vector form is rather involved; an approximate formula is then developed and its limitations pointed out.

The Testing of Audio Frequency Transformer-Coupled Amplifiers, H. Diamond and J. S. Webb. Inst. of Radio Engrs.—Proc., vol. 15, no. 9, Sept. 1927, pp. 767-791, 21 figs. Performance of an audio-frenquency transformer-coupled amplifier is considerably affected by reaction load across coupling-transformer secondary due to impedance in plate circuit of tube following transformer; effect of such reaction is discussed in paper, and several methods of test described whereby actual performance of a given amplifier under any condition of loading (due to reaction) may be measured.

RAILS

GUARD. The Why and How of Guard Rails. Ry. Eng. & Maintenance, vol. 23, no. 10, Oct. 1927, pp. 401-402, 1 fig. Committee report of Metropolitan Track Supervisors' Club points to advantages of one-piece manganese construction for severe service.

RAILWAY MANAGEMENT

COST ACCOUNTING. Cost Accounting and the Operating Expense Classification, C. E. Parks. Ry. Age, vol. 83, nos. 8 and 11, Aug. 20 and Sept. 10, 1927, pp. 339-341 and 479-482. Aug. 20: Purpose of cost accounting in railroad industry; cost groups; results of cost accounting; elements of cost in railway operation. Sept. 10: How operating expense classification meets requirements of cost accounting.

RAILWAY MOTOR CARS

DEVELOPMENTS. The Development of the Steam Rail Motor Car. Ry. Engr., vol. 49, no. 573, Oct. 1927, pp. 378-385, 14 figs. Details of Clayton steam cars and Egyptian State Railways car designed and built by Clayton Wagons. Limited, of Lincoln, for service on the London & North Eastern and Egyptian State Railways.

RAILWAY REPAIR SHOPS

LOCOMOTIVE. Locomotive Maintenance Work at Camaguey, Cuba, F. H. Colvin. Am. Mach., vol. 67, no. 14, Oct. 6, 1927, pp. 531-534, 11 figs. Machine tool equipment and other devices in shops of Cuba Railway at Garido, near Camaguey.

MILLING MACHINES. Where Savings Await Canadian Railroads, H. Rowland. Can. Machy. & Mfg. News, vol. 38, no. 17, Sept. 22, 1927, pp. 11-14, 8 figs. Describes use of milling machine in New England railway repair shop; adaptable to variety of work; increases production and saves time.

RAILWAY SIGNALLING

COLOURED-LIGHT SIGNALS. Canadian National Signalling Construction Standards Are High. Ry. Signalling, vol. 20, no. 10, Oct. 1927, pp. 376-380, 10 figs. Completes 41-mile double-track installation of colour-light signals on its main line between Chicago and Toronto; several novel departures in design and construction are found.

Colour Light Signalling at York Road Station, Belfast. Ry. Gaz., vol. 47, no. 13, Sept. 23, 1927, pp. 366-369. In conjunction with permanent-way rearrangement, system of colour light signalling has been brought into use at L.M.S.R. Northern Counties Committee's Belfast Terminus, including unusual and noteworthy features.

ELECTRIC POWER FOR. Electrical Power for Railway Signalling and Communications, M. G. Tweedie. Int. Ry. Congress Assn.—Bul., vol. 9, no. 9, Sept. 1927, pp. 773-806, 10 figs. Sources of supply usually available; circuits and apparatus using power; application of various sources of power to circuits and apparatus.

REMOTE CONTROL. Remote Control of Railway Junctions, F. R. Wilson. Elec. Times, vol. 6, no. 8, Aug. 27, 1927, pp. 561-564, 7 figs. Describes electric power signalling system installed on Victorian Railways and method of remote control.

RAILWAY SWITCHES

REMOTE CONTROL. Canadian National Provides Remote Power Switches at International Bridge, C. H. Tillett. Ry. Signalling, vol. 20, no. 10, Oct. 1927, pp. 368-371, 10 figs. Ten switchmen and highway flagmen relieved by power operation of switches, bridge and rail locks, and gates for highway and pedestrian traffic.

Canadian Pacific Installs Signals and Remote Control Switches, C. R. Hodgdon. Ry. Signalling, vol. 20, no. 10, Oct. 1927, pp. 372-374, 6 figs. Seventy miles of single-track automatics, including three remote power switches, are operated by primary batteries.

RAILWAY TRACK

CORROSION. Is the Control of Brine Drippings an Impossible Task? Ry. Eng. & Maintenance, vol. 23, no. 10, Oct. 1927, pp. 404-407, 2 figs. Various committee reports on corrosive effect of brine drippings from refrigerator cars; list of protective materials now in use or under test and results secured.

SECOND-TRACKING PROBLEMS. Second-Track Work Involves Extensive Line Revision. Ry. Age, vol. 83, no. 14, Oct. 1, 1927, pp. 633-637, 8 figs. Increased traffic on Missouri Pacific necessitates double tracks on several lines; 109 mi. of second-track work projected; problems presented by line revision.

RECLAMATION

MONTAUK BEACH, N.Y., WORK AT. Building a Great Lake and Water Resort, F. W. Skinner. Eng. & Contracting, vol. 66, no. 9, Sept. 1927, pp. 395-398, 6 figs. Engineering and construction operations for Montauk Beach development, Long Island, New York, requiring an expenditure of $50,000,000 for utilities, buildings and improvements. See also Roads & Streets, vol. 67, no. 9, Sept. 1927, pp. 381-383, 7 figs., and Municipal News, vol. 73, no. 3, Sept. 1927, pp. 54-56, 7 figs.

RECTIFIERS

JET-WAVE. Development of the Jet-Wave Rectifier, J. Hartmann. Engineering, vol. 124, nos. 3217 and 3218, Sept. 9 and 16, 1927, pp. 338-340 and 377-380, 25 figs. Sept. 9: Principle underlying jet-wave rectifiers and commutators; building jet-wave rectifiers of practically any size; commutator and commutation. Sept. 16: Stabilized commutators; auxiliary-electrode problem; electrodes for rectified current; hydrodynamic circuit; medium for commutation.

MERCURY-ARC. Iron Type Mercury-Arc Power Rectifiers, H. Platz. A.E.G. Progress, vol. 3, no. 9, Sept. 1927, pp. 273-278, 8 figs. Introduction of iron rectifier for converting alternating current into direct current; advantages and applications of rectifier.

REDUCTION GEARS

LIMITATIONS. Speed Reducers, C. H. Grill. Indus. Eng., vol. 85, no. 9, Sept. 1927, pp. 401-404, 6 figs. Some of the inherent limitations that must be considered when applying these devices to industrial power drives.

REFRACTORIES

PROPERTIES. Refractories: Their Properties and Adaptabilities, L. N. Rancke. Am. Gas Jl., vol. 127, no. 7, Sept. 1927, pp. 35-39. Defines and discusses uses of acid, semi-basic, basic and neutral refractories; functions of firebrick; refractory failures, etc.

REFRIGERATING MACHINES

LUBRICATION. Effective Lubrication of Refrigeration Machinery, A. F. Brewer. So. Power Jl., vol. 45, no. 9, Sept. 1927, pp. 54-61, 12 figs. The nature of the process demands more careful study than does many other lubrication problems; refrigerant, the system, temperatures, size of equipment and other factors all set up limitations which must be religiously observed if continuous and efficient refrigeration is to be gained.

REFRIGERATING PLANTS

OPERATION. Cold Storage Operation and Computations, W. R. Woolrich. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1101-1104, 3 figs. Effect of various factors upon refrigerating requirements shown by calculation; effects of outside temperatures.

REFUSE DISPOSAL

GREAT BRITAIN. Refuse: Its Storage, Collection and Disposal, T. Douglas. Surveyor (Lond.), vol. 72, no. 1860, Sept. 16, 1927, pp. 251-252. Survey of modern methods in storage, collection and disposal of domestic refuse.

RESERVOIRS

RELINING. Relining of the Volunteer Park Reservoir, Seattle. West. Constrn. News, vol. 2. no. 19, Oct. 10, 1927, pp. 66-71, 7 figs. Details of relining of city reservoir; preliminary investigation of various cements; tests for permeability, tensile strength, absorption, compression and fineness; specifications as finally decided upon.

TAF FECHAN, WALES. The Taf Fechan Reservoir and Works. Engineer, vol. 144, nos. 3733 and 3734, July 29 and Aug. 5, 1927, pp. 113-116 and 144-147, 11 figs. Capacity of 3,400 million gal., area of 349 acres; drainage area, 6,338 acres. See also Engineering, vol. 124, nos. 3210 and 3211, pp. 116-117 and 125-128, 25 figs., and Water & Water Eng., vol. 29, no. 344, Aug. 20, 1927, pp. 309-317.

RETAINING WALLS

RELIEVING PLATFORM TYPE. A Novel and Economical Type of Retaining Wall, R. McC. Beanfield. West. Constr. News, vol. 2. no. 17, Sept. 10, 1927, pp. 31-34, 14 figs. Retaining wall for Beverly Hills residence based on principle of utilizing weight of embankment material to counteract or minimize moments exerted by thrust of fill, this being accomplished by employment of an interior platform slab on which is loaded the backfill.

ROADS, CONCRETE

MIXTURES. The Economics of Concrete Mixes for Road Work, R. T. Giles. Eng. News-Rec., vol. 99, no. 13, Sept. 29, 1927, pp. 512-513, 2 figs. Strength secured by extra thickness at equal cost using 1:2 mortar ratio with controlled sand bulking and stone voids.

STEEL BONDING FOR. Rational Design of Bonding Steel in Concrete Roads, E. E. Bauer. Eng. News-Rec., vol. 99, no. 12, Sept. 22, 1927, pp. 462-463, 3 figs. Purposes of steel in concrete pavements and how to design steel to meet specific purposes.

ROAD CONSTRUCTION

ILLINOIS. Station Work—Day Labour Road Building, C. M. Hathaway. Eng. News-Rec., vol. 99, no. 11, Sept. 15, 1927, pp. 432-434. Grading by station method; force work for paving; water shipment problems; flood delays.

MATERIALS. Highway Construction, C. M. Upham. Indus. & Eng. Chem., vol. 19, no. 10, Oct. 1927, pp. 1121-1122. Chemically manufactured materials used in road construction, with particular reference to asphalt, tar, brick and steel.

WINTER. Winter Construction Methods and Plant, C. S. Hill. Eng. News-Rec., vol. 99, no. 11, Sept. 15, 1927, pp. 421-424, 4 figs. Winter excavation and embankment construction.

ROADS, CONSTRUCTION

WINTER. Winter Construction Methods and Plant, C. S. Hill. Eng. News-Rec., vol. 99, no. 12, Sept. 22, 1927, pp. 466-469, 3 figs. Concrete road construction in winter.

Winter Construction Methods and Plant, C. S. Hill. Eng. News-Rec., vol. 99, no. 13, Sept. 29, 1927, pp. 506-510, 8 figs. Winter heating of concrete materials and mix.

Winter Construction Methods and Plant, C. S. Hill. Eng. News-Rec., vol. 99, no. 14, Oct. 6, 1927, pp. 544-548, 5 figs. Handling and placing concrete in winter; loss of heat in placing; reheating in transit; heat development after placing; limiting placing temperatures; preparing foundation and placing under water; detecting frozen concrete; thawing frozen concrete.

Winter Construction Methods and Plant, C. S. Hill. Eng. News-Rec., vol. 99, no. 15, Oct. 13, 1927, pp. 597-599, 3 figs. Protecting winter placed concrete in heavy sections.

ROADS, EARTH

CRUSHED STONE SURFACING. Low Cost Improvement of Earth Roads with Crushed Stone, A. T. Goldbeck. Highway Engr. & Con., vol. 17, no. 4, Oct. 1927, pp. 48-50, 5 figs. Describes method of improving roads at average cost of $3,000 per mile, including grading, drainage and surfacing; consists of using small sized crushed material applied at rate of from 500 to 1,000 tons per mile and periodically bladed so as to maintain thin, loose layer of stone on the surface.

ROLLING MILLS

CONTINUOUS SKELP MILL. Wheeling Steel Corp.'s New Skelp Mill, D. N. Watkins. Blast Furnace & Steel Plant, vol. 15, no. 9, Sept. 1927, pp. 435-437, 8 figs. Mesta Machine Company has designed new type continuous electrically driven skelp mill using edging roll; special interest attached to new type electric flying shears.

ELECTRIC DRIVE. Recent Developments in Electric Drives for Rolling Mills, L. A. Umansky. Indus. Eng., vol. 85, no. 9, Sept. 1927, pp. 420-424, 8 figs. Describes several layouts for combination of electrical machines in various mills.

S

SAND

PLANTS. Design of Sand and Gravel Plants, F. M. Welch. Eng. & Contracting, vol. 66, no. 9, Sept. 1927, pp. 411-412. Different plants of Greenville (Ohio) Gravel Corpn. designed to fit varying conditions; newest plants incorporate most recent developments in design; feeders, elevators, crushing equipment, sand-settling tanks, bins and housing.

VOLUME, EFFECT OF MOISTURE ON. Effect of Gradation on Bulking of Sand and Gravel, H. Allen. Eng. World, vol. 31, no. 2, Aug. 1927, pp. 94-97, 1 fig. Tests made in Road Materials Laboratory of Kansas State Agricultural College to secure data on increase in volume of sand-gravels of different gradations due to moisture content.

SCREW THREADS

SPECIFYING. How to Specify Screw Threads, C. W. Bettcher. Iron Age, vol. 120, no. 12, Sept. 22, 1927, pp. 791-792. Nomenclature adopted in the report of the National Screw Thread Commission; also some considerations in connection with design of gauges; use of recommended standard thread sizes important.

SEAPLANES

DEVELOPMENT. Seaplane Development, R. E. Penny. Roy. Aeronautical Soc.—Jl., vol. 31, no. 201, Sept. 1927, pp. 844-874 and (discussion) 874-885, 30 figs. Touches on some of more important features of seaplane design: design of aircraft structure in relation to boat and float seaplane; hull and float design and construction progress in flying boat design; future development of seaplane; stability problems of flying boats and float seaplanes.

SEWAGE DISPOSAL

ACTIVATED SLUDGE. Notes on the Clarification Stage of the Activated Sludge Process, A. S. Parsons and H. Wilson. Surveyor & Mun. & County Engr., vol. 72, no. 1859, Sept. 9, 1927, pp. 221-225, 2 figs. Study of empirical rules governing activated sludge process; experimental work and deductions; clarification stage of process discussed; reactivation and nitrification stages must also be recognized.

PLANTS. The Operation of Sewage Treatment Plants, T. C. Schaetzle. Water Works, vol. 66, no. 10, Oct. 1927, pp. 407-410. Recommendations for obtaining maximum efficiencies in sewage treatment plants; methods and equipment.

SCREENINGS, BURNING. Experience in Destroying Sewage Screenings by Burning, R. A. Appleton. Eng. News-Rec., vol. 99, no. 13, Sept. 29, 1927, pp. 500-502, 2 figs. Review of records at Long Beach disposal plant; notes on incinerator operation using natural gas fuel.

SEWAGE TREATMENT. Chicago Sewage Treatment Plants. Public Works, vol. 58, no. 9, Sept. 1927, pp. 339-341. Plants under construction and contemplated; North Side works the largest activated sludge plant yet constructed; West Side tanks to digest sludge from North Side works; skimming tanks, Imhoff tanks, sewage and sludge pumps.

SMOKE

ABATEMENT. Smoke-Abatement Methods Used in Cleveland, E. H. Whitlock. Mech. Eng., vol. 49, no. 10, Oct. 1927, pp. 1071-1075, 7 figs. Review of work of Smoke Department of Cleveland and results; experiments and tests; railway and marine co-operation.

SNOW REMOVAL

HIGHWAYS. Keeping Roads Open During the Winter, A. A. Smith. Contract Rec. & Eng. Rev., vol. 41, no. 40, Oct. 5, 1927, pp. 1027-1029. Ontario's experience with snow removal; last year 800 miles of provincial highways were kept open to traffic; growing demand for roads that are open twelve months a year.

STEAM

UNDERGROUND DISTRIBUTION SYSTEMS. Underground Steam Distribution Systems, L. A. Foster. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1096-1099, 4 figs. High-pressure steam from central boiler plant serves many purposes besides affording cleanliness, health and convenience in cities; adaptation of superheat; auxiliary equipment; economics.

STEAM-ELECTRIC PLANTS

ILLINOIS. Waukegan Places 50,000-Kw. Turbine Unit in Service. Power, vol. 66, no. 11, Sept. 13, 1927, pp. 386-389, 6 figs. New unit uses steam at 600-lb. pressure and 725 deg. fahr. superheat, and is bled at four points to heat feedwater; economizer and air preheaters are used; air temperature is raised to 350 deg. fahr. for use under chain grates; electrical features are two-motor drive of induced-draft fans, two-speed vertical motors for circulating pumps, full-voltage starting of 2300-volt auxiliary motors, metal-clad switchgear, busbars for all potentials and armored cables for all auxiliary services; main 12,000-volt Reyrolle switches are reported to be largest of their kind in world.

STEAM ENGINES

RECIPROCATING. The Reciprocating Steam Engine: Its Present and Future Positions. Shipbldr., vol. 34, no. 206, Oct. 1927, pp. 512-513. Possibilities of reciprocating steam engine for ship propulsion; higher steam pressures and temperatures; superheated steam; valve arrangements; reciprocating engine of 500-lb. steam pressure; Bauer-Wach system of reciprocating engine and exhaust steam turbine for single-shaft propulsion; uniflow engine.

STEAM POWER PLANTS

PEORIA, ILL. Steam Economy at the Peoria Plant of the Commercial Solvents Corporation, W. I. Nevius. Power, vol. 66, no. 12, Sept. 20, 1927, pp. 438-440, 4 figs. How substantial savings were effected in spite of cheap coal and simple plant layout.

TORONTO, CANADA. Proposed Auxiliary Steam Plant, Toronto, Can. Engr., vol. 53, no. 11, Sept. 13, 1927, pp. 297-299. Engineers report that operation of steam power plant in conjunction with Toronto hydroelectric system would result in substantial savings under certain conditions; analysis of costs.

STEAM TURBINES

BLEEDER. Calculating Extraction Turbine Performance, K. S. Kramer. Power Plant Eng., vol. 31, no. 20, Oct. 15, 1927, pp. 1075-1076, 2 figs. Details of method used in locating feedwater heaters for best economy, calculating steam to be held, and gain in efficiency over non-extraction operation.

STEEL

AUTOMOBILE BODIES. Steel Required in Automobile Bodies. Iron Age, vol. 120, no. 12, Sept. 22, 1927, pp. 779-781, 6 figs. Special qualities in sheets more successfully obtained by showing steel manufacturers exact requirements than by buying on strict specifications; development in use of steel for automobile bodies by Edward G. Budd Mfg. Co.

COLD-ROLLING. The Influence of Cold-Rolling and Subsequent Annealing on the Hardness of Mild Steel, C. A. Edwards and K. Kuwada. Iron & Steel Inst.—Advance Paper, no. 3, Sept. 1927, 17 pp., 15 figs. Also Iron & Coal Trades Rev., vol. no. 3109, Sept. 30, 1927, pp. 496-498, 15 figs.

COLD-WORKED. Plastic Flow and the Strength of Cold-Worked Steel, E. B. Norris. Eng. News-Rec., vol. 99, no. 14, Oct. 6, 1927, pp. 548-549, 3 figs. Stress referred to reduced cross-section; test results; correlation of stress and reduction of diameter.

HARDNESS. The Work-Hardening of Steel By Abrasion, E. G. Herbert. Iron & Steel Inst.—Advance Paper, no. 7, Sept. 1927, 12 pp., 12 figs. Describes an investigation into hardness induced by severe abrasion in locomotive tires and rails, and in hardened steel gears and cams from motor-cars; hardness induced by wear is compared with the "maximum induced hardness" measured by a recently developed test made with pendulum hardness tester.

EFFECT OF TEMPERATURE ON PROPERTIES. Effect of Temperature on the Mechanical and Microscopic Properties of Steel. G. C. Priester and O. E. Harder. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 3, Sept. 1927, pp. 436-445, 12 figs. Describes results obtained on tests of a quenched 0.29 per cent carbon steel at temperatures up to 1112 deg. Fahr. (600 deg. cent.) and on same steel as hardened, tempered at temperatures up to 1112 deg. fahr. (600 cent.) and then tested at room temperature; only tensile strength tests were made at elevated temperatures; tests at room temperature include hardness and impact toughness.

NICKEL. *See Nickel Steel.*

NORMAL. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 3, Sept. 1927, pp. 413-435 and 478, 45 figs. Discussion of paper by J. D. Gat and by S. Epstein and H. S. Rawdon on normal and abnormal steel; includes results of investigation conducted to show that structural abnormality is not inherent and can be introduced by selective straining.

Normality of Steel, J. D. Gat. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 3, Sept. 1927, pp. 376-413, 28 figs. Paper written to bring better understanding of term "normality of steel" and properties possessed by steels classified as abonormal; describes experiments to demonstrate behaviour of steel having different grain size and amounts of segregated cementite; properties of "cementitic lining" present in abnormal steels; concludes that resistance to uniform hardening is caused by high oxygen content forming a eutectoid alloy with the constituents of austenite.

NORMAL AND ABNORMAL. Progress in Study of Normal and Abnormal Steel, S. Epstein and H. S. Rawdon. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 3, Sept. 1927, pp. 337-375, 21 figs. Normal and abnormal steel defined and characteristics of normal and abnormal structure in carburizing steel and tool steel illustrated; shows that under certain quenching conditions abnormal steel is more prone to give soft spots than normal steel, but that with drastic quenching in brine or in a sodium hydroxide solution, it is possible completely to prevent formation of soft spots in both normal and abnormal steel; normality and abnormality have origin in deoxidation procedure of steel making; additions of aluminum and ferrovanadium in mould produced abnormality.

TEMPERING. On the Mechanism of the Tempering of Steels, T. Matsushita and K. Nagasawa. Iron & Steel Inst.—Advance Paper, no. 10, Sept. 1927, 12 pp., 10 figs. In the course of investigation of physical properties of quenched steels during tempering, authors observed some unexpected facts which have an important bearing on elucidation of phenomenon of tempering; present paper contains a description of these phenomena, and also a new view concerning mechanism of tempering. Bibliography.

STEEL CASTINGS

FEEDING AND GATING. The Feeding and Gating of Steel Castings, A. Rhydderch. Foundry Trade Jl., vol. 36, no. 578, Sept. 15, 1927, pp. 233-236. Introduction to fundamental principles and considerations in gating and feeding of steel castings; follows path of metal from time it leaves ladle until castings are completed.

MANGANESE-STEEL. Precision Equipment Finishes Manganese Steel Parts Rapidly. Abrasive Industry, vol. 8, no. 10, Oct. 1927, pp. 320-323, 8 figs. Cleaning room equipment of Chicago Heights plant of Am. Manganese Steel Co.; selection and testing of grinding wheels.

STEEL FOUNDRIES

EQUIPMENT MAINTENANCE. Details of a Simple Equipment Record System Used in a Large Steel Foundry, J. Thomson. Indus. Eng., vol. 85, no. 9, Sept. 1927, pp. 415-419 and 435, 8 figs. Necessity for keeping equipment in perfect working condition and study of system in use by Hubbard Steel Foundry Co., East Chicago, for equipment maintanence records.

STEEL, HEAT TREATMENT OF

ANNEALING. Electric Annealing Solves Machining Problem at Timken Plant. Elec. World, vol. 90, no. 15, Oct. 8, 1927, pp. 729-730. Exacting requirements in heat-treating high-carbon, high-chromium steel; 850-kw. pit type electric furnace anneals 84-ton charge of steel bars.

BIBLIOGRAPHY. Books on the Heat Treatment of Steel, E. H. McClelland. Forging—Stamping—Heat Treating, vol. 13, no. 9, Sept. 1927, pp. 369-371. Treatises written in English, French and German, dealing with the subject in all its branches; most of the publications are modern.

EFFECT OF. The Heat Treatment of Various Steels, L. C. Miller. Forging-Stamping-Heat Treating, vol. 13, no. 9, Sept. 1927, pp. 362-365. Effects of various chemical elements on the method fo heat treatment and resultant physical properties of steels.

HUMP METHOD. The Hump Method of Heat Treating, J. W. Harsch. Forging-Stamping-Heat Treating, vol. 13, no. 9, Sept. 1927, pp. 372-373, 4 figs. Description of a means for determining the critical point based on the expansion and contraction of steel when subject to heat; chart records change in object.

PRINCIPLES. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. for Steel Treat.—Trans., vol. 12, no. 3, Sept. 1927, pp. 479-491, 3 figs. Use of vanadium in various types of steel; heat treatments, properties, and uses of different types of steel are described.

STOKERS

CHAIN-GRATE. Increasing the Efficiency of Chain Grate Stokers, A. E. Grunert. Indus. Power, vol. 8, no. 3, Sept. 1927, pp. 45-47 and 66-72, 2 figs. Composition of combustion gases from fuel bed of a chain grate stoker is such that further development of furnace must take wide variations of conditions into account; investigations as to character of gases arising from fuel bed with idea of finding some means of reducing objectionable conditions usually encountered.

STRESSES

PHOTO-ELASTIC MEASUREMENT. Photo-Elastic Measurements of Stress Distribution, E. G. Coker. Roy. Soc. of Arts Jl., vol. 75, no. 3903, Sept. 9, 1927, pp. 1017-1028, 11 figs. Fundamental principles of photo-elasticity and their application to measurement of stress; apparatus and instruments; mapping lines of stress and shear; measurements of stress distribution, Cantor lecture.

STRUCTURAL STEEL

HEMISPHERICAL DOME. Structural Details of a Steel-Framed Hemispherical Dome, H. F. Blood. Eng. News-Rec., vol. 99, no. 14, Oct. 6, 1927, pp. 542-543, 2 figs. Solid-web ribs and horizontal rings from framework of dome in Portland; rib sections straight between panel points.

SUBSTATIONS

SAFE DESIGN. Safety in Substation Design, F. D. Wyatt. Elec. Light & Power, vol. 5, no. 10, Oct. 1927, pp. 34 and 96, 4 figs. Typical safety feature incorporated in design of fully automatic substation recently placed in service in residence district of Cincinnati.

SURVEYING

Measuring Tapes. Testing of Measuring Tapes at the Bureau of Standards. U.S. Bur. of Standards—Dept. of Commerce, no. 328, May 17, 1927, 16 pp., 15 figs. Testing of steel tapes used by engineer and surveyor is done at Bur. of Standards by comparison with a steel bench standard described in this paper; for test of base-line tapes (usually made of invar with a length of 50 m.) a much more elaborate apparatus is employed; this geodetic comparator is also described in detail.

T

TAPS

Design and Construction. Design and Construction of Taps, A. L. Valentine. Machy. (Lond.), vol. 30, no. 778, Sept. 8, 1927, pp. 705-709, 4 figs. Deals with Acme-thread taps, square-thread taps, staybolt taps, and taper-threaded taps.

TELEPHONE LINES

Loading. A New Era in Loading, W. Fondiller. Bell Lab. Rec., vol. 5, no. 1 Sept. 1927, pp. 1-6, 5 figs. Development of suitable designs of loading coil to meet severe conditions of modern telephone network.

TELEPHONY

Automatic. Some Notes on the Brighton Automatic Telephone Network, W. A. Sallis. Jr. Instn. Engrs. Jl., vol. 37, part 11, Aug. 1927, pp. 548-583. Outlines principle and main features of Siemens' No. 16 system, with particular regard to installations in Brighton area; endeavours to set forth that which was considered to be outstanding from point of view of engineering interest and ingenuity, and at same time give some idea of method and manner of adapting modern automatic telephone system to social and business requirements of community.

TERMINALS, RAILWAY

Toronto. Toronto Union Station, History, Description, Etc. Can. Ry. & Mar. World, no. 356, Oct. 1927, pp. 567-576, 13 figs. Description of various sections of new Union Station at Toronto; general design of buildings, ramp chamber, general waiting room, ticket lobby, rest rooms, dining room and concourse; heating, ventilating and refrigeration; lighting; water and gas supply and fire protection; elevators.

TEXTILE MILLS

Reliable Industrial Power Supply. Elec. World, vol. 90, no. 14, Oct. 1, 1927, pp. 660-662, 4 figs. Fall River Elec. Light Co., plans progressive development of feeder layouts to supply widely sepraated textile mills; effective relay installation.

TEXTILES

Automobile Industry. Coated Textile, H. Bradshaw. Indus & Eng. Chem., vol. 19, no. 10, Oct. 1927, pp. 1109-1110. Three types of coated textile whose basic materials are, respectively, pyroxylin, linseed oil, and rubber, and their contribution to the economic development of the automobile.

Celanese. "Celanese" Manufacture: A New Canadian Industry, H. Price. Can. Chem. & Metallurgy, vol. 11, no. 10, Oct. 1927, pp. 269-270. Development of manufacture of new textile and description of process.

TIN ALLOYS

Lead-Tin. Effect of Work and Annealing on The Lead-Tin Eutectic, F. Hargreaves. Inst. of Metals—Advance Paper, no. 444, 1927, 12 pp., 6 figs. Marked softening action of work air temperature on lead-tin eutectic; effect of different degrees of working; annealing at air temperature and at 100 deg. cent. for different periods and effect on rate and extent of recovery in hardness; effect of annealing at just below the melting point.

TOOLS

High-Frequency Portable. High-Frequency Portable Tools Effecting Economies. Automotive Indus., vol. 57, no. 14, Oct. 1, 1927, pp. 480-484, 11 figs. Rather recent development in portable tool field and one which appears to be of considerable importance from standpoint of production economies is type of tool powered with polyphase induction motor operated on high-frequency current; usually 180 cycles; principal feature of this type of tool.

TORNADOES

St. Louis. Building Destruction in the St. Louis Tornado, W. J. Knight. Eng. News-Rec., vol. 99, no. 14, Oct. 6, 1927, pp. 558-560, 3 figs. Great storm on Sept. 29 sweeps residence districts from southwest to northeast; principal damage to frame and combination buildings; weak roof construction and anchorage a factor.

TRANSFORMERS

Oils. Evaluation of Transformer Oils, J. G. Ford. Indus. & Eng. Chem., vol. 19, no. 10, Oct. 1927, pp. 1165-1171, 10 figs. In evaluating oils for transformer use, consideration must be given to flash and fire points, viscosity, specific gravity, pour point, dielectric strength, presence of inorganic acids, alkalies and salts, sulphur content, and finally to tendency to form deposits known as sludge.

TUNNELING

Costs. Mucking Costs Below Mining Costs. Eng. & Contracting, vol. 66, no. 5 May 1927, pp. 205-214, 21 figs. How tunneling costs were reduced by equipment designed by city engineers on part of force account tunnel job in Chicago; other methods used on work.

W

WASTE HEAT

Utilization. Waste Heat Utilization in Compressor Plants, F. L. Kallam. Nat. Pet. News, vol. 19, no. 38, Sept. 21, 1927, pp. 218-224, 1 fig. Points out causes for increased interest in compression gasoline system and shows how stabilizer affords means of utilizing compressor plant heat than by greatly increasing economy of heat.

WATER PIPES

Stacks, Pressure Developed in. Pressures in Stacks in Tall Buildings, H. E. Babbitt. Domestic Eng. (Chicago), vol. 120, no. 13, Sept. 24, 1927, pp. 21-23, 5 figs. Tests in 14-storey office building to determine pressures created by water discharged into 4- and 5-in. stacks from tank placed on roof.

WATER POWER

Alberta. Geological Problems of the Spray Water Power Project in Alberta, J. A. Allan. Eng. Jl., vol. 10, no. 10, Oct. 1927, pp. 447-451, 4 figs. Outline of general plan of development, with details of geological investigation carried on in connection with proposed works.

WOOD PRESERVATION

Douglas Fir. Creosote Treatment of Douglas Fir, R. H. Rawson. West. Constr. News, vol. 2, no 18, Sept. 25, 1927, pp. 51-57, 4 figs. Tests on Douglas fir beams treated with creosote.

WATER SOFTENING

Glauconite. Glauconite in Water Softening, R. H. Emerick. Power, vol. 66, no. 11, Sept. 13, 1927, p. 401. Author distinguishes between Glauconite and Zeolite and presents evidence to show that it is former and not latter that possesses water-softening properties; its origin and preparation are also discussed.

Zeolite. Zeolite Water-Softening Treatment, R. M. Moore. Nat. Pet. News, vol. 19, no. 38, Sept. 21, 1927, pp. 283-284, 1 fig. Zeolite method of softening hard water, with particular reference to work of oil companies.

WATER WORKS

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WOODWORKING MACHINERY

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WOODWORKING PLANTS

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